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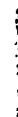
FIELD MANUAL

THE FIELD ARTILLERY SEARCHLIGHT BATTERY

HEADQUARTERS, DEPARTMENT OF THE ARMY

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FIELD MANUAL

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HEADQUARTERS
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THE FIELD ARTILLERY SEARCHLIGHT BATTERY

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*This manual supersedes FM 6-115, 30 March 1966.



CHAPTER 1

GENERAL

1-1. Purpose and Scope

This manual is a guide for the commander and personnel of the field artillery searchlight battery. It will assist the commander in developing the battery into an efficient, smooth-working unit capable of operating effectively in combat. The manual covers organization, command, and tactical control. It includes information about unit capabilities and limitations, battlefield illumination, and control and direction of illumination necessary for commanders and staffs at all echelons employing the field artillery searchlight. The material presented herein is applicable without modification to nuclear and conventional warfare, and to stability operations.

1-2. Changes or Comments

a. Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Changes to Publications) and forwarded direct to Commanding Officer, United States Army Combat Developments Command Field Artillery Agency, ATTN: CAGFA-DC, Fort Sill, Oklahoma 73503.

b. Changes involving safety of personnel should be transmitted by electrical means.

1-3. Mission

The mission of the field artillery searchlight battery is to furnish direct or indirect illumination with either visible or infrared light in support of tactical night operations within division and corps areas.

1-4. Terms and Definitions

a. *Action Complete*. Report of compliance with the last correction or command.

b. *Cut*. Command to turn off the searchlight; corresponds to the command CHECK FIRING.

c. *Direct Illumination*. Illumination provided by direct light from pyrotechnics or searchlights.

d. *Field Artillery*. The term "artillery" used throughout this manual means "field artillery" Deference to air defense artillery (ADA) is specified as such.

e. *Flick*. Command to turn on the searchlight; corresponds to the command FIRE.

f. *Hold*. Command to keep the searchlight on the same azimuth, elevation, and beam spread; corresponds to the command REPEAT.

g. *Hold-Cut*. Command used when the forward observer wants the lights off but laid in the same direction.

h. *Indirect Illumination*. Illumination by diffusion or reflection, obtained by using a searchlight from defilade.

i. *Infrared Illumination*. A type of illumination that emits infrared radiation that is not within the light spectrum visible to the unaided eye.

j. *Light Direction Center (LDC)*. The element of a searchlight platoon consisting of light direction personnel and equipment, by means of which light direction and control are exercised.

k. *Pencil beam (focused)*. Optimum beam focus (30 mils wide).

l. *Spread (Reduce) Beam*. Command to increase (decrease) the width of the searchlight beam.

m. *Spread Beam (Defocused)*. Mode used in direct illumination to obtain a larger beam width. Beam range and intensity decrease as beam width increases.

n. *Visible Illumination*. That light which can be seen by the unaided eye.



CHAPTER 2

COMMAND, CONTROL, AND ORGANIZATION

Section I. GENERAL

2-1. Command and Control

The field artillery searchlight battery is assigned to corps artillery. The searchlight battery commander is the searchlight adviser to the corps artillery commander, who, in turn, advises the corps commander in the use of searchlights, units to be supported, areas to be covered, times of employment, and other matters pertaining to the illumination plan. Guidance in the use of searchlight illumination is contained in FM 20-60.

2-2. Capabilities and Limitations of Employment

a. The capabilities of the searchlight battery include but are not limited to the following:

(1) The battery can provide mobile battlefield illumination—visible and infrared—within the zone of action of a corps under normal conditions.

(2) Each platoon is capable of providing mobile battlefield illumination within the zone of action of a division under normal conditions.

(3) The battery has sufficient communications equipment to communicate with organic platoons and searchlight sections.

(4) The battery is capable of providing organizational maintenance for organic equipment.

(5) The battery is 100 percent mobile, is air transportable (Phase I), and is helicopter transportable.

(6) Platoons and sections can operate independently for limited periods of time. When employed in this manner, the platoon or section may require augmentation from the battery communication section or other sections.

b. The searchlight battery has certain limitations ((1) through (6) below) which should be considered in its employment.

(1) The battery has no survey capability. When the battery is operating in general sup-

port of a corps, survey must be provided by the corps artillery. When the battery is operating with platoons in direct support of divisions, survey must be provided the platoon by the supported division artillery.

(2) The battery communication capability is limited to providing organic internal communications. When the battery is operating in general support of a corps, additional communications personnel and equipment must be provided by corps artillery for initial laying and maintenance of wire lines. When the platoon is augmented with a wire team from the battery communication section, it has a limited wire-laying and maintenance capability. Any additional support required must be provided by the supported unit. Maximum use is made of existing circuits and radio nets for long-range communications.

(3) The platoons of the battery may be dispersed over a corps zone of action beyond the reach of the battery Class I support and resupply facilities. The sections of each platoon so dispersed should be satellited on the nearest unit or units for such logistic support.

(4) The supply and maintenance facilities of the battery are limited. Platoons assigned a direct support mission must be provided logistical support, to include resupply of POL (petroleum, oil, and lubricants), and assistance in organizational maintenance of equipment by the supported unit(s). When the battery is assigned the mission of general support of the corps, platoons may be attached to the nearest artillery unit for logistical support.

(5) The battery has no unit-level medical capability and must be provided such support.

(6) When a section is detached from this platoon, it loses access to centralized light direction. Light direction must be accomplished by the section itself or by a nearby fire direction center.

Section II. TACTICAL MISSIONS

2-3. General

The searchlight battery may be assigned the standard tactical mission of general support or direct support. Also, each of the three platoons may be assigned a separate tactical mis-

sion. The battery may be attached in its entirety, by platoon, or by individual searchlight section to another unit for a battlefield, rear area, or stability operations illumination mission. The responsibilities inherent in each of these standard missions are tabulated in figure 2-1.

	<i>Direct support</i>	<i>General support</i>
Answers calls for illumination from—	Supported unit.	Supported unit or higher artillery headquarters.
Establishes liaison with—	Supported unit. (Command liaison).	No inherent requirement.
Establishes communication with—	Supported unit. (Appropriate artillery headquarters will assist when necessary)	No inherent requirement. (Internal communications only.)
Has as its zone of operation—	Zone of action of supported unit.	Zone of action of supported unit.
Furnishes forward observers—	No requirement. (Use forward observers from direct support artillery battalion w/maneuver element control.)	No requirement.
Displaces when—	Deemed necessary, after approval of appropriate Artillery headquarters.	Ordered by force headquarters, or by higher artillery headquarters.
Illumination plan prepared by—	Supported unit or higher artillery headquarters.	Supported unit or higher artillery headquarters.

Figure 2-1. Field artillery searchlight battery tactical missions. (Inherent responsibilities).

2-4. General Support

A searchlight battery normally is assigned the mission of general support and provides illumination in support of the corps. Batteries assigned a general support mission are controlled by the corps artillery commander through his fire direction center.

support to a designated unit. Normally, each of the platoons will be assigned a mission of direct support of a division, in which case the division artillery commander, through his fire direction center, exercises operational control over the searchlight platoon to include logistical and some administrative support.

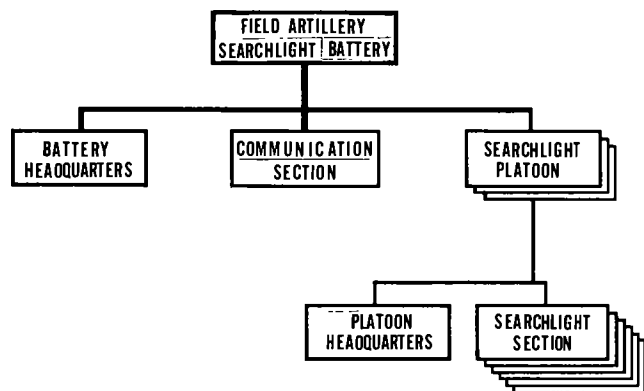


Figure 2-2. Organization of the searchlight battery.

2-5. Direct Support

A searchlight platoon can be assigned the mission of direct support to provide illuminating

2-6. Operational Control

Operational control specifically does not include administrative or logistics support. Searchlight battery elements are in many instances widely separated from their parent battery, and therefore the parent unit is not capable of providing all administrative or logistic support required by its elements. Orders which place searchlight sections out under operational control of other headquarters must clearly state what support will be required by these elements to insure understanding by supported units. Battery commanders are responsible for insuring that orders carry appropriate modifying instructions to spell out administrative and logistic functions required of any headquarters given operational control of elements of the battery.

2-7. Modified Missions

a. Searchlight units may be assigned standard missions, modified or amplified by appropriate instructions. Such modified missions may pertain to task force or separate operations. When a standard tactical mission is modified, unit capabilities should not be degraded. Searchlight units normally are assigned only general support or direct support missions.

b. In stability operations, searchlight sec-

tions may operate for extended periods of time separately from the battery in direct support of units smaller than corps and division, such as brigades or security forces of logistical complexes and small defended areas such as special forces camps.

c. Other areas of modified support are river patrol operations, border denial operations, static checkpoints, and coordinated river/sea and land operations.

Section III. ORGANIZATION

2-8. General

The battery consists of the personnel and equipment necessary to accomplish the illumination mission, movement, administrative functions, and, to a limited extent, the communication, supply, maintenance, and mess functions.

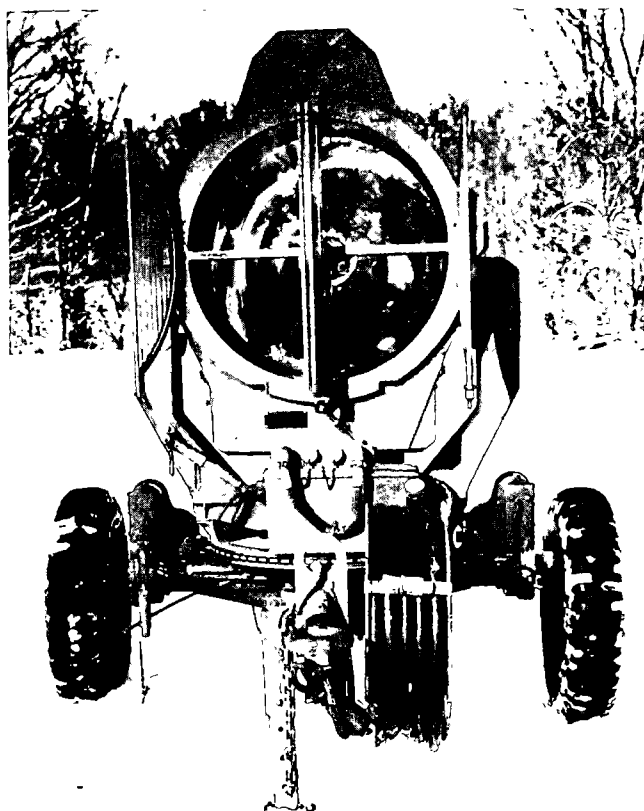


Figure 2-3. 30-inch Xenon searchlight, trailer mounted.

2-9. Battery Organization

a. The organization of the searchlight battery (fig 2-2) is similar to that of a cannon battery. The 30-inch Xenon searchlight battery consists of—

- (1) A battery headquarters.
- (2) A communication section.
- (3) Three searchlight platoons, each con-

sisting of a platoon headquarters and six searchlight sections.

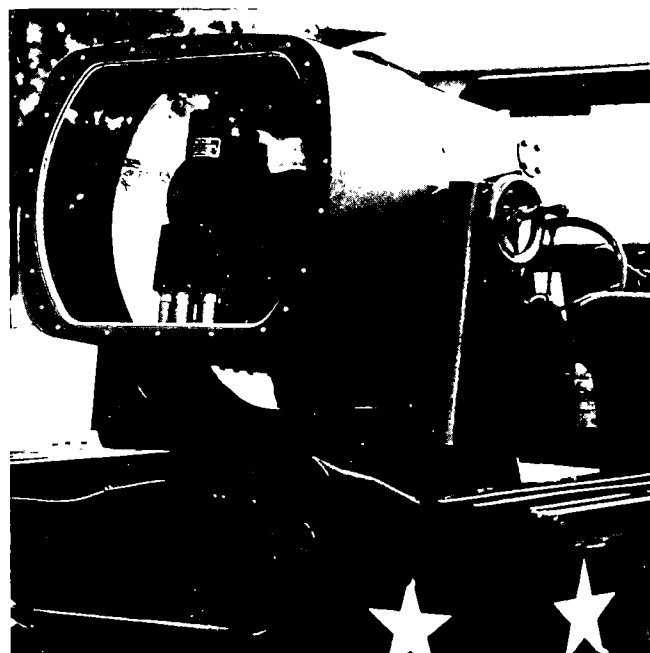


Figure 2-4. 23-inch Xenon searchlight, 1/4-ton truck mounted.

b. The battery headquarters consists of the personnel and equipment necessary to perform administrative, supply, mess, and motor maintenance functions for the battery when operating as an integral unit.

c. The communications section consists of the personnel and equipment necessary to perform the battery radio and wire functions and limited battery-level maintenance of communications equipment.

d. Each searchlight platoon consists of the platoon headquarters and six searchlight sections. Each platoon has the personnel and equipment necessary to operate a light direction center (LDC) and to perform searchlight illumination.

e. Each searchlight section consists of a chief of section, two searchlight crewmen, and a

searchlight power generator operator; a 30-inch Xenon searchlight, trailer-mounted (fig 2-3); an engine-generator, trailer-mounted; and a ¼-ton truck and a ¾-ton (or 1 ¼-ton) truck (prime mover) for the searchlight and engine generator, respectively. Duties of the searchlight section personnel are given in appendix C.

f. In stability operations, the 30-inch Xenon searchlight may be replaced by two 23-inch searchlights. When this occurs, the ¾-ton(1¼-

ton) truck (prime mover) with trailer is replaced by an additional ¼-ton truck. Both ¼-ton trucks are given an increased power capability by mounting 100 ampere generator adaption kits. A crew of two is used to operate each 23-inch searchlight. Each searchlight section equipped with 23-inch Xenon searchlights consists of two 23-inch lights (fig 2-4), a section chief, two operators, and one generator operator. The section is then reorganized to place two men on each light.

CHAPTER 3

RECONNAISSANCE, SELECTION, AND OCCUPATION OF POSITION (RSOP)

Section I. GENERAL

3-1. Purpose

The purpose of reconnaissance, selection, and occupation of position (RSOP) is to move a unit from a previous illuminating position, from a rendezvous or bivouac area, or from the march into a position from which it can provide the illumination required to accomplish its mission. A battery is said to be in position when its platoons and searchlights are ready to illuminate.

3-2. Tasks Involved

Placing the battery headquarters and platoons into position involves—

- a. Reconnaissance, selection, and occupation of the position area. Platoons with a direct support mission will accomplish RSOP independently of the battery headquarters.
- b. The formulation of a plan for occupying the area selected, to include positions for

searchlights, access routes to searchlight positions, and wire routes.

- c. The issuance of orders to carry out the plan.

- d. The execution of the order (the actual emplacement of the various elements).

3-3. Reconnaissance

The tactical employment of searchlights normally should permit daylight reconnaissance, selection, and preparation of the searchlight positions and the battery command post area. The procedures prescribed in FM 6-140 regarding RSOP by cannon batteries generally apply to movement by the battery headquarters and the searchlight platoons. During low-intensity combat, increased security procedures by ground reconnaissance parties are required for protection from insurgent ambush or other attack. For a detailed discussion of artillery reconnaissance, see FM 6-140.

Section II. SELECTION OF POSITIONS

3-4. General

Normally, the mission of the battery requires deployment over a wide front; therefore, the selection of a position for each battery element is discussed separately. Seldom will all elements of the battery be concentrated into a single battery area.

3-5. Basic Considerations

The positions of the battery elements should be easily accessible and should have separate routes for entrance and exit. Normal procedure is for the battery to make a night occupation. When a position is to be occupied during daylight hours, special attention must be given to dispersion and camouflage. Whenever possible, separate day and night positions should be selected for each element of the battery, especially for the searchlight section. Local security is a basic consideration especially in stability operations.

3-6. Battery Command Post Area

The battery command post normally is located adjacent to the corps artillery headquarters or, in stability operations, with the major supported headquarters to facilitate liaison and planning of support operations. In a general support role, the battery receives its missions from the corps artillery fire direction center. The battery commander, as searchlight adviser to the corps artillery commander, must maintain continuous personal or representative liaison with the corps artillery headquarters.

3-7. Platoon Headquarters

The platoon headquarters is located where it can best direct the operations of its searchlights. In a direct support role, the platoon headquarters is located in proximity to the supported artillery headquarters and receives its missions from that fire direction center. The light direction center should be adjacent to the supported unit's artillery fire direction center.

3-8. Searchlight Positions for Direct Illumination

a. General. When searchlights are used for direct illumination, positions must be selected to enable line-of-sight coverage of the target area. When possible, positions should be outside the range of enemy small arms or mortars and outside the effective range of direct fire weapons. Multiple coverage of the same target or area is desirable; positions should be selected that insure direct illumination from more than one searchlight on each target or area. Positions should also be selected in width and depth to permit delivery of light from different areas at staggered time intervals so that continuous illumination of a single target is possible while some degree of security is afforded the searchlights.

b. Reconnaissance. A detailed map reconnaissance is always made before attempting to select a direct illumination position. A map profile

in the vicinity of the searchlight position for occupancy during daylight or other nonoperating periods.

c. Selection of Positions. Searchlight positions selected for direct illumination should be on high ground to afford maximum range and flexibility and to avoid silhouetting friendly troops located along or near the axis of the beam. Defilade from flank observation is desirable since it will deny the enemy bilateral observation (fig 3-1).

d. Occupation of Position. Since direct illumination is accomplished from exposed positions, occupation and withdrawal should be accomplished under cover of darkness. Equipment and personnel occupying these positions should be limited to the minimum requirements for operating the searchlights.

3-9. Searchlight Positions for Indirect Illumination

When searchlights are used for indirect illumi-

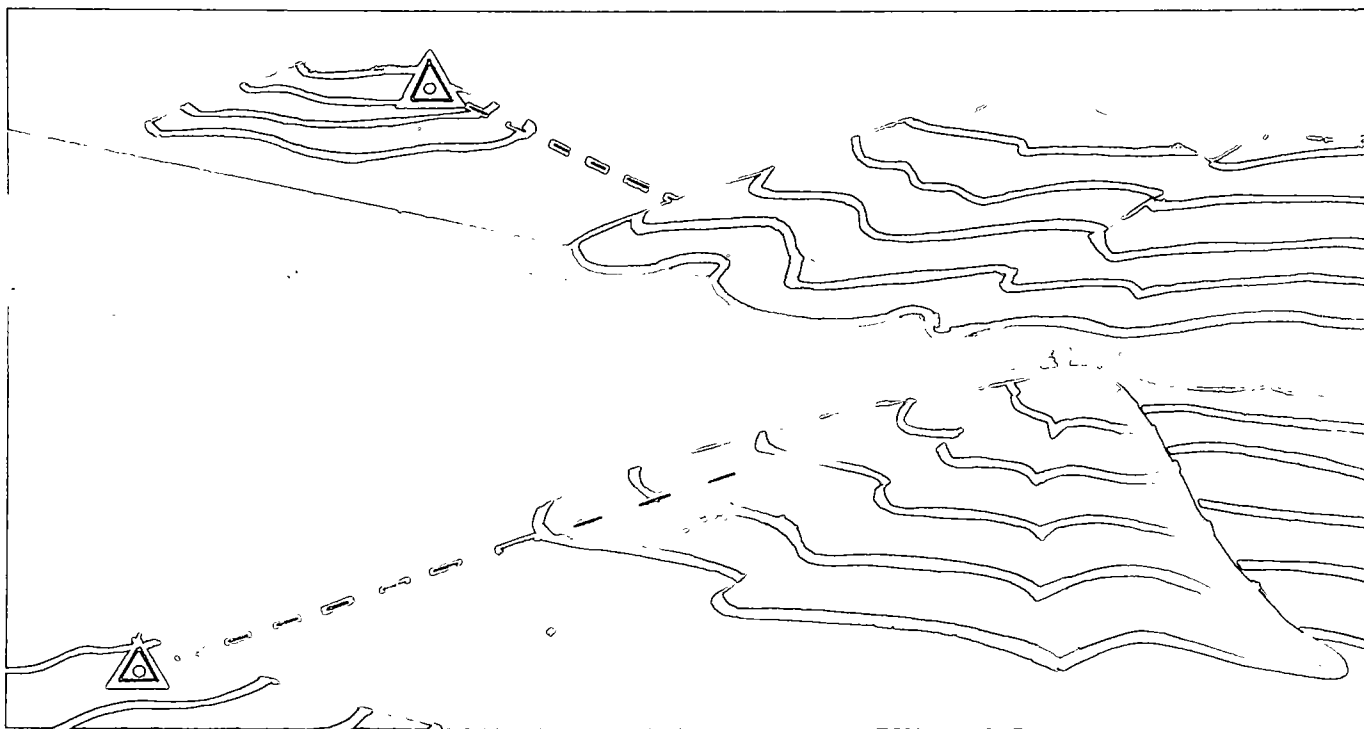


Figure 3-1. Position denying bilateral observation.

should be drawn to insure that a given searchlight position permits line-of-sight to the target area. After the map reconnaissance is made, a ground reconnaissance is conducted to determine access routes and the suitability of the position. Since the position is normally occupied in dusk or darkness, provision should be made for route marking. An area which will provide cover and concealment and facilitate supply and maintenance activities should be selected

nation, the searchlight positions are selected to provide a minimum mask of 8 meters for each 200 meters distance from the searchlight to the mask (fig 3-2). The least searchlight elevation will provide the most effective ground illumination. However, the use of deep defilade and maximum searchlight-to-mask distances will considerably reduce the enemy's capability to deliver accurate artillery fire on the searchlight position (unless the position is located

by an air observer). Open areas are highly desirable for searchlight positions for indirect illumination because trees, brush, or other close objects may obscure portions of the searchlight beam and necessitate the use of higher elevations. Very high searchlight beam elevations assist the enemy in accurately determining the location of the searchlight position by intersec-

tion methods. Searchlight positions normally are selected an appropriate distance (3,000 to 8,000 meters) behind the forward edge of the battle area (FEBA) or area to be illuminated, and are spaced laterally at intervals as dictated by the terrain, disposition of friendly forces, target area, and desired intensity of illumination.

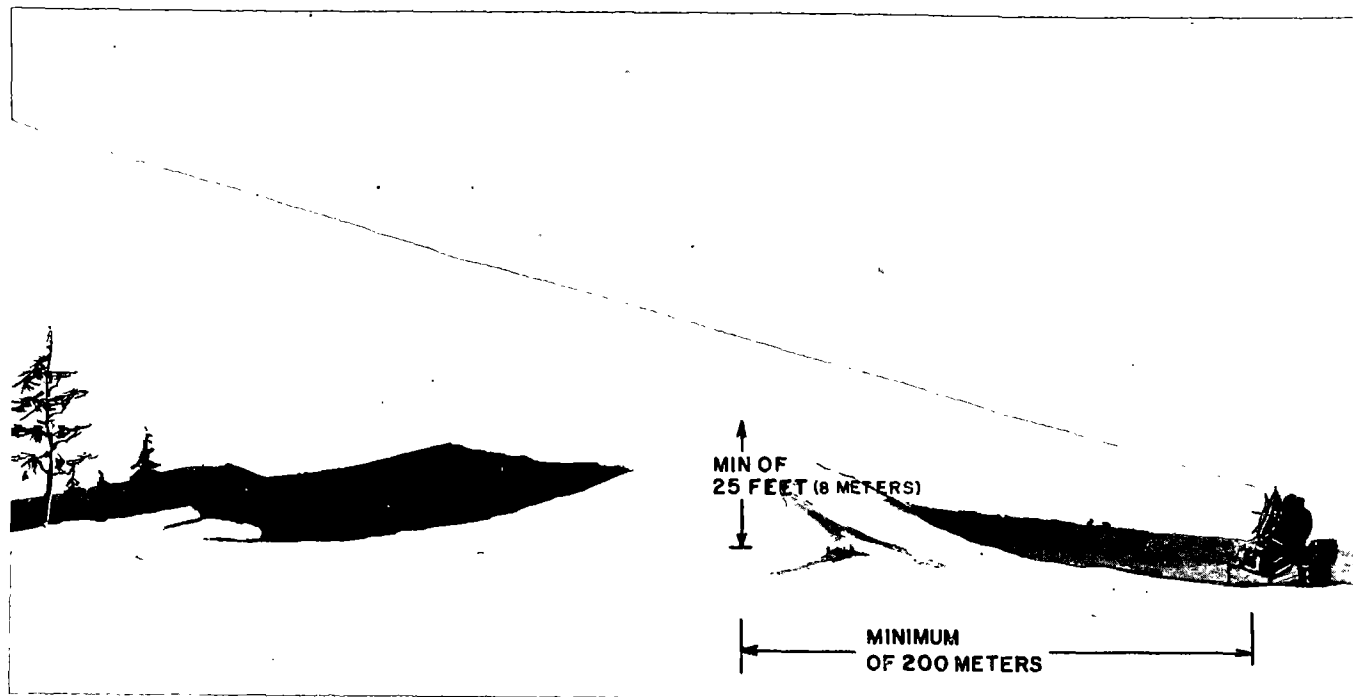


Figure 3-2. Position for indirect illumination.

Section III. OCCUPATION OF POSITION

3-10. General

A standing operating procedure (SOP) is necessary to assure a rapid and orderly occupation of position. The SOP is prescribed by the battery commander based on the principles set forth in paragraphs 3-11 through 3-14.

3-11. Procedure in Occupation of Position

a. Guides. Reconnaissance party personnel are designated as guides to meet the elements of the battery as they arrive at the position area. Each guide is responsible for guiding one of the battery elements to its selected location. During a night operation, each vehicle is met by a guide at the entrance to the position area and directed to its proper location.

b. Movement Into Positions. Movements in the vicinity of the position should be made at reduced speed. Care must be exercised in occupying a position to avoid areas not cleared of

mines and to avoid making new tracks that will reveal the position to air observers. Only the necessary vehicles are brought into the command post area, and those that are not needed for operation are quickly unloaded and dispersed. Camouflage is used to conceal positions.

c. Night Occupation. When possible, a daylight reconnaissance should be made prior to occupying a position under cover of darkness. Continuous practice in night occupation of position is necessary. All personnel must be thoroughly briefed on the route of march, and route markers must be provided. A night occupation will be slower than a daylight occupation, but it must be just as orderly and efficient. Noise and light discipline must be observed. Generator noise may require posting of listening posts some distance from generators.

d. Placement of Equipment. Rapid displacement and night movements make it imperative

that each battery element work out an efficient system of loading and unloading equipment. The chief of section supervises the loading of equipment and sees that all equipment is in its proper place before he reports his section in order. Only required items are unloaded at the position.

3-12. Sequence of Occupation

Those installations which are immediately necessary for the accomplishment of the assigned mission must be established first.

a. Battery Command Post Area. The installation of the elements with the minimum communication network necessary for operation is the first priority task. Other battery headquarters installations are established as directed by the battery commander.

b. Platoon Headquarters Area. In the platoon headquarters area, the LDC along with its communication network has first priority.

c. Searchlight Position Areas. Dug-in positions for searchlights are prepared before occupation whenever possible. Preparation of searchlight positions prior to occupation facilitates an orderly and efficient occupation.

3-13. Communication and Survey

a. Communication. Radio contact is maintained during the march unless radio silence or listening silence has been directed. When advance warning of a mission or a move is received, installation of necessary wire lines is completed prior to occupation of position; otherwise, the installation of wire lines begins when the battery (platoon or section) reaches its position.

b. Survey. The grid reference of each searchlight position is plotted on the light direction chart. When accurate maps are available, map inspection will provide a sufficiently accurate location for light direction purposes pending

completion of survey. When advance warning of a mission or move is received, the battery should request the supported unit to establish survey control prior to occupation of position.

3-14. Reports

Upon occupation of position, each searchlight chief of section will report to his platoon light direction center. His report will include—

a. The map coordinates of his position. This can be determined by inspection; by intersection using his compass and map; or by survey if available.

b. The minimum elevation(s) to clear any mask across the entire sector assigned to the searchlight section.

c. The azimuth on which the searchlight is laid. The searchlight may be laid as follows—

(1) *By compass.* Measure an azimuth to a distant aiming point; mark the position of measurement; move the searchlight over the marked point; level the light and lay on the distant aiming point; set the announced azimuth on the sliding azimuth scale and move it opposite the azimuth index. Select an azimuth in the general direction of anticipated searchlight action and traverse light to that azimuth; a stake may then be set in line for reference purposes only.

(2) *By aiming circle.* Lay aiming circle on grid north; refer to searchlight sight and read azimuth; level the light and lay on the aiming circle; compute the back azimuth from aiming circle to light; set that azimuth on the sliding azimuth scale and move it opposite the azimuth index; select an azimuth in the general direction of anticipated action and traverse light to that azimuth. A stake may then be set in line for reference purposes only.

d. A statement that the searchlight section is ready for action.

CHAPTER 4

ORGANIZATION OF POSITION

4-1. General

Organization of position consists of the operations necessary to permit the unit to accomplish its mission. Organization begins when the position area is selected, and development and improvement of the position continues as time permits until the area is vacated.

4-2. Communication

When the establishment of the battery communication network is not initiated prior to occupation of position, it is begun immediately thereupon. The principles set forth in chapter 5 are followed in the development of the battery communication system.

4-3. Survey

The location of each searchlight position must be established on the appropriate light direction chart. As a temporary expedient when accurate maps are available, the searchlight positions may be located by inspection, intersection, or resection. These positions are surveyed as soon as possible and the locations are replotted on the light direction chart. Personnel and equipment to perform the necessary survey are provided by either the corps or the supported unit. Survey should be completed prior to occupation of position when possible.

4-4. Security

a. Headquarters Elements. The battery and platoon headquarters are dependent upon the security organization of the supported unit. The searchlight battery headquarters security measures are integrated into the corps artillery headquarters local security plan. When the platoons are employed in direct support of divisions, the platoon headquarters' security measures are integrated into the supported division artillery security plan.

b. Searchlight Sections. The defense of each searchlight position must be coordinated with the security system of the nearest unit. Communications are established with that unit as an essential part of such defensive measures. The infrared capability enhances local perimeter defense and should be employed in conjunction

with automatic weapons that are collocated with the searchlight.

4-5. Camouflage

a. As the battery elements occupy their respective positions, every effort must be made to maintain the initial appearance of the area. In most positions, camouflage is attained by use of the issue camouflage net garnished with burlap strips or natural vegetation. For a detailed discussion of camouflage techniques, see FM 5-20.

b. Considerations of concealment sometimes conflict with protective measures against shellfire or bombing. In such cases, the battery (platoon) commander(s) must weigh the relative advantages and disadvantages of each in selecting and camouflaging the area. For example, a position under trees may provide excellent concealment, but the danger of shells or bombs striking the trees may outweigh the advantage of concealment.

4-6. Searchlight Emplacements

a. General. The searchlight emplacements should meet the following requirements:

- (1) Permit the section to accomplish its searchlight missions.
- (2) Afford maximum concealment.
- (3) Afford quick movement of the searchlight to alternate positions.
- (4) Provide maximum all-round protection for personnel and equipment against small-arms fire, artillery fire, and aerial bombardment.
- (5) Allow for use of infrared capability for local defense or infrared illumination of targets for supported units.

b. Preparation of Emplacements. When advance warning of a mission or move is obtained, the battery (platoon) commander(s) should have positions for the searchlights prepared prior to the arrival of the searchlight sections.

c. Alternate Positions. Alternate positions for the searchlights should be selected and prepared. If time permits, the preparation of the alternate position may be as detailed as that accomplished at the main position. This is par-

ticularly true when the unit is supporting defensive operations and the enemy possesses a capability to attack with superior forces.

d. Supplementary Positions. Supplementary

positions should be selected and, time permitting, prepared for the illumination of targets that cannot be reached from the primary or alternate positions.

CHAPTER 5

COMMUNICATION

Section I. GENERAL

5-1. General

The ability of a searchlight battery to furnish effective support depends on efficient communications. Communications must be reliable, flexible, and secure. The commander must always consider the effect of communications upon the employment of the battery. Within the limits of the unit's capabilities, the commander provides adequate communications with elements of his command and with supported and adjacent units. The commander insures that all personnel of his command are adequately trained in the use of the several means of communications. (For a detailed discussion of field artillery communications, see FM 6-10.)

5-2. Special Communication Considerations

a. The searchlight battery is generally deployed over a corps front. Acquisition of the

supported units SSI and SOI are mandatory to insure communications with users. The installation and maintenance of wire lines, and the great distances involved make assistance from the supported unit necessary for successful operation. The area communications system, which is installed by the signal units, is used to augment artillery communications systems; it is also used as an alternate means of communication. The area system offers a means for expeditiously establishing a wire network between artillery elements when the length of lines required exceeds the capabilities of the units to establish and maintain them.

b. Deployment in stability operations may encompass extended distances. Such distances and the nature of insurgent activity increase reliance upon radio as the primary means of communication (para 5-8).

Section II. WIRE COMMUNICATION

5-3. General

The searchlight battery makes maximum use of existing wire lines. The type of wire system installed depends on the length of time the position is to be occupied. Each searchlight platoon will generally operate as a separate tactical unit; therefore, the discussion of platoon communications requirements will pertain to each platoon. When a position is to be occupied for a relatively short period of time, only direct circuits should be installed between the supported unit and the light direction center. Wire circuits parallel the radio channels and take over the communications load as they are installed. Wire systems are expanded and improved by the installation of additional local lines, duplicate circuits, and lateral lines until the wire net fulfills the communications requirements of the situation.

5-4. Wire System Installation

Wire systems (fig 5-1) are installed in order of priority as determined by the assigned mission, the tactical situation, and availability of

personnel and equipment. Wire circuits should be installed to provide—

a. The minimum wire circuits necessary to perform the primary mission of the battery.

b. Additional circuits for command and control.

c. Expansion of remaining communications requirements.

5-5. Installation Priority

The wire circuits that are necessary to accomplish the assigned mission normally are installed as follows:

a. Local circuits (telephone to switchboard) from—

(1) The corps artillery FDC to the battery switchboard.

(2) The platoon LDC to the supported division artillery FDC switchboard.

(3) Each searchlight section to the nearest artillery switchboard.

b. Direct circuits (telephone to telephone)—between the two telephones of each searchlight section.

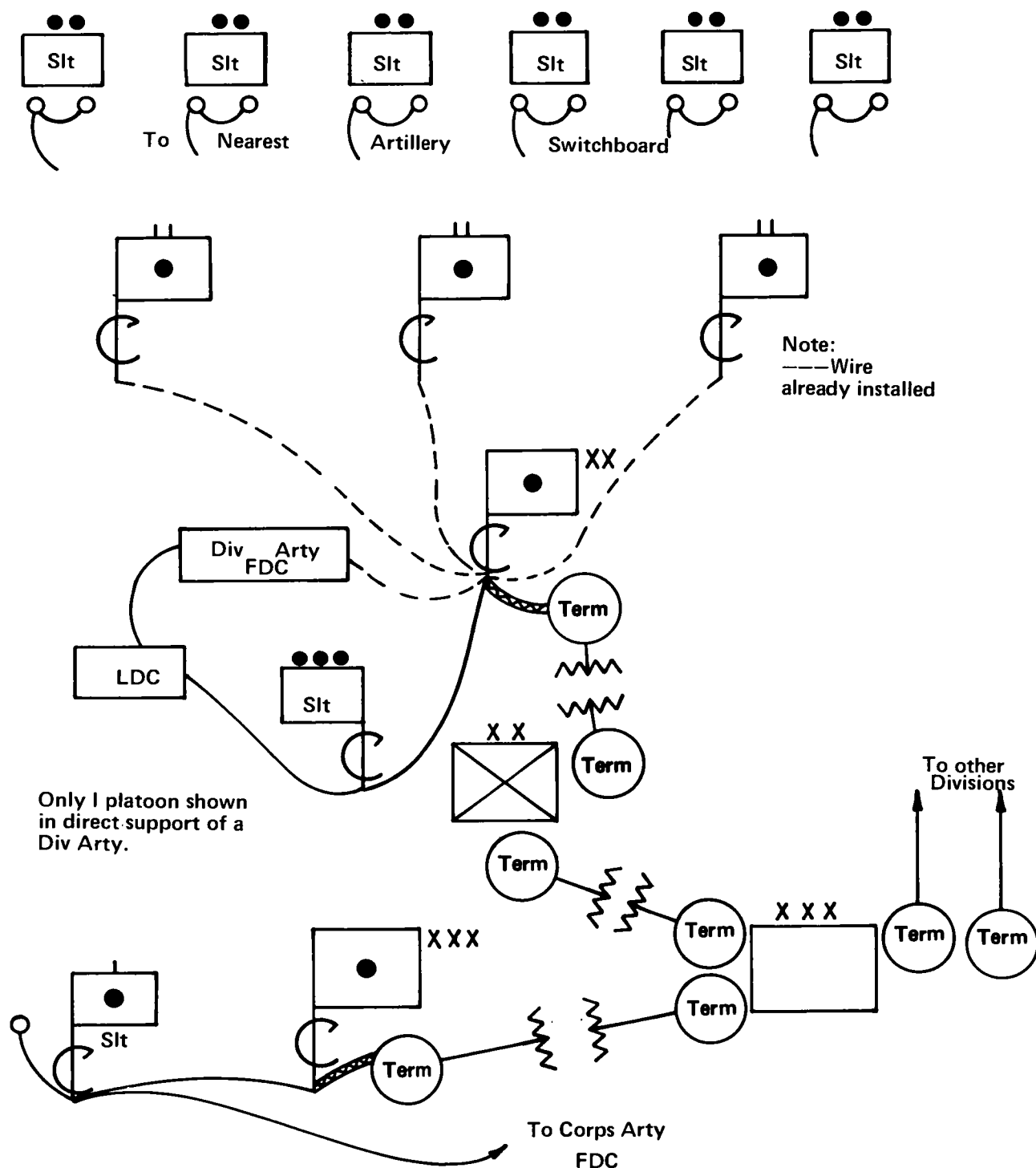


Figure 5-1. Type wire system, field artillery searchlight battery.

c. Trunk circuits from—

- (1) The corps artillery switchboard to the battery switchboard.

(2) The platoon switchboard to the supported division artillery switchboard.

d. Local circuits (switchboard to telephone)
—from platoon switchboard to platoon LDC.

5-6. Other Priorities (Improvement)

Additional circuits may be installed for improvement and will be accomplished as the mission and situation dictate. This phase also includes policing and maintaining existing circuits.

5-7. Wire Installation Responsibilities

a. *Battery Wire Team.* The battery wire personnel install and maintain all internal lines of the searchlight battery and platoons.

b. *The Supported Unit.* Wire personnel from the searchlight battery install and maintain wire lines to the supported artillery switchboard. (Example: From the searchlight section

to an artillery switchboard, forward switch, etc.) When personnel and equipment necessary for the installation and maintenance of these circuits are not available, the circuits will be installed as directed by higher headquarters.

c. *Corps Artillery.* Wiremen of the corps artillery communications platoon install and maintain trunks between the corps artillery and searchlight battery headquarters.

Section III. RADIO COMMUNICATION

5-8. General

Initially, upon occupation of position, radio communication is used. As the wire nets are established, radio traffic loads should decrease. Radio is then used only when the wire system fails, is overloaded, or does not include a particular installation. In stability operations, greater reliance must be placed on radio communication than on wire, because of the vulnerability of wire to insurgent action.

5-9. Radio Facilities

a. *General.* Installation of the radio equipment organic to the searchlight battery will be as shown in figure 5-2. The distribution of this equipment may be modified to accomplish a particular mission (e.g., task force operations).

b. *Channels and Frequencies.* Radio channels and frequencies are assigned to the battery by the corps artillery signal officer in the signal operating instructions. The number of channels and frequencies assigned to a searchlight battery depends on the requirements of the situation and the number available. Normally, the searchlight battery headquarters will require only one channel for use as the battery net.

c. *Battery Radio Sets in Other Nets.* In addition to the net(s) established within the battery, elements of the searchlight battery operate in or monitor other nets. These nets include the corps artillery command/fire direction net FM,

the supported division artillery command/fire direction net, FM, and other nets as directed.

d. *Type Battery Radio Systems.* Figure 5-2 illustrates a typical battery radio system when each platoon is in direct support of a division.

5-10. Radio Nets

a. *Battery Command Net.* The battery command net is used for the transmission of administrative and tactical messages among elements of the battery.

b. *Corps Artillery Command/Fire Direction Net, FM.* The battery commander and the battery headquarters radio sets operate in the corps artillery command/fire direction net, FM. The battery receives command and administrative messages from corps artillery over this net.

c. *Supported Division Artillery Command/Fire Direction Net, FM.* Each platoon operates in the supported division artillery command/fire direction net, FM. This net is used primarily for the exchange of command and administrative messages and for coordination between the platoon and the supported division artillery headquarters. This net is used by the platoon leader to conduct liaison with the supported unit.

d. In stability operations, searchlight platoons and sections may be required to operate in other than United States forces communications nets. Such nets would be indicated by the assigned tactical mission (FM 6-20-1) or specified in the operations order.

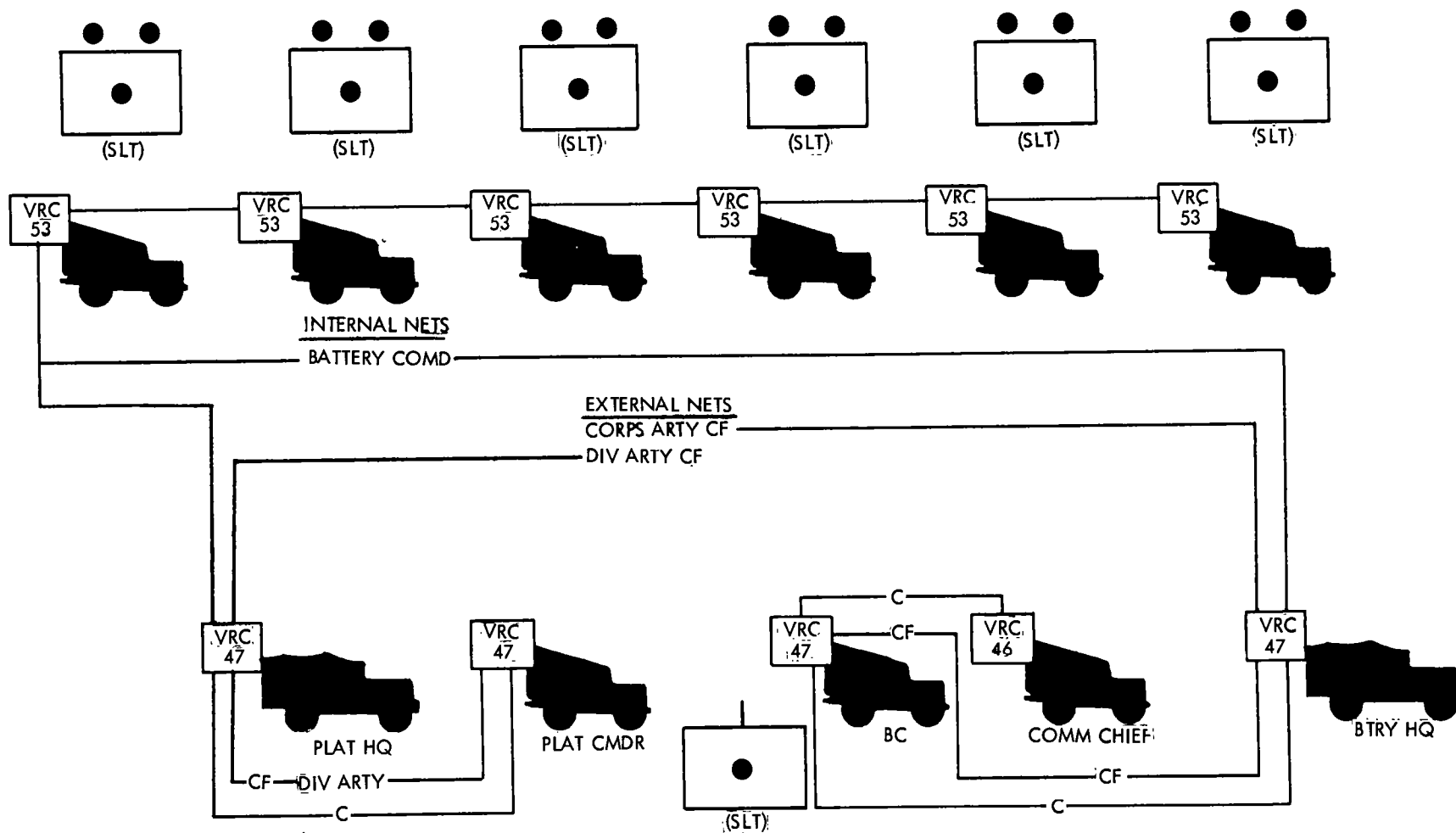
Section IV. COMMUNICATIONS SECURITY (COMSEC) CONSIDERATIONS

5-11. General

Due to the special threat posed to the enemy by operations undertaken at night, it should be assumed that he may give special emphasis to efforts to determine friendly plans for night operations, and to interfere with execution of those plans. The relatively unique role of the searchlight battery in these operations makes it a potentially lucrative target for these efforts.

5-12. The Communications-Intelligence Threat

The communications structure, usage patterns, and message traffic content associated with searchlight battery operations can provide enemy communications intelligence elements with invaluable insights not only into the plans and activities of the battery itself but, more importantly, into night operations plans and



NOTE: Only one platoon shown

Figure 5-2. A typical searchlight battery radio net.

activities of the supported commands. Exchanges of messages incident to reconnaissance and occupation of positions, as described in chapters 3 and 4, can serve to alert the enemy to the possibility of impending night operations. The content and patterns of messages exchanged among battery elements, the light direction center, and the supported commands may provide more definitive tipoffs on planned activities. The content of illumination request messages may provide details on specific objectives and tactical events. Intercept and direction-finding on battery radios at searchlight positions may enable the enemy to locate such positions and either bring fire to bear on them or evaluate the meaning of light adjustment messages. Short-term tipoffs for immediate reaction, such as taking cover, may be possible through intercept and analysis of illumination requests and adjustment messages as described in chapters 8 and 9.

5-13. The Electronic Countermeasure (ECM) Threat

Searchlight battery radio communications will not generally present profitable targets for enemy electronic countermeasures activities. There are, however, special events and times during battery operations at which friendly operations could be adversely affected by ECM against battery communications. For example, jamming initiated following the exchange of "AT MY COMMAND" and "READY" transmissions between a forward observer and a light direction center could interfere with reception

of the implementing "FLICK" message. The enemy might use imitative communications deception (ICD) to inject false illumination requests or adjustment messages to cause illumination missions to be undertaken at times and against targets (e.g., friendly force elements) advantageous to him.

5-14. Other COMSEC Considerations

For the reasons cited above, special attention should be given at all times to communications security for battery communications and for external communications associated with battery activities. FM 6-10 and FM 24-1 contain general unclassified doctrine and guidelines on communications security. Additional general doctrine is contained in FM 32-5. The following guidelines are especially pertinent to battery communications activities:

- a. Use wire and messenger communications means wherever practicable, especially during planning phases.
- b. Use cryptologic devices, where available, to encipher radio message texts, or (as a minimum) those message text elements such as target identification and times which will reveal specific details on impending activities.
- c. Authenticate all radio transmissions, and request a second authentication in event of suspected ICD.
- d. Minimize the use of radios collocated with searchlight positions.
- e. Avoid patterns of radio usage and message transmissions which can be associated with patterns or sequences of events in battery operations or operations of the supported commands.



1

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CHAPTER 6

BATTLEFIELD ILLUMINATION

Section I. DIRECT ILLUMINATION

6-1. General

Searchlight illumination should provide friendly forces with sufficient light to assist them in the conduct of operations at night and yet deny equal advantage to the enemy. Direct illumination is provided by placing the visible searchlight beam on the target (fig 6-1). Infrared direct illumination operations conducted in a similar manner are discussed in paragraphs 6-13 through 6-17. Maximum illumination is obtained from the 30-inch Xenon searchlight

The searchlight beam can be spread to 160 mils (spread beam) to cover a larger area, but an increase in beam width decreases the effective range and intensity of the light on the target (table 6-1).

6-2. Characteristics of Direct Illumination

a. An observer using direct illumination and having the light source at his back can observe into the illuminated area nearly as well as in daylight. Observers should be off the light



Figure 6-1. Direct illumination.

when it is used in this role. The usable range of a focused (pencil) beam (30 mils wide) on a clear night is approximately 15,000+ meters.

Note. Testing of the maximum capabilities of the Xenon family of searchlights has not been completed, but 15,000 meters can be used as a planning guide.

target line because reflection of particles in the air can make viewing difficult. When the observer is observing from an angle of 10 to 45 degrees with respect to the light beam, observation is enhanced. Deep shadows cast by brush and other objects, because of low elevation of

Table 6-1. Capabilities of Xenon Family of Searchlights

Tabulated Data	23-inch	30-inch
1. Physical Characteristics:		
a. Weight	245 pounds	1200 pounds (with generator 3100 pounds)
b. Candlepower	75 million minimum	400, 650, 800 million or 1 billion minimum
c. Beam width (pencil)	9 to 13 mils	30 mils
(spread)	120 mils	160 mils (180 mils if spread beam lens is used)
2. Operational Characteristics:		
a. Range (meters) 1		
(1) Infrared	5000	7500+
(2) Visible—		
Spread	4000+	10,000+ 2
Pencil	5000+	15,000+ 2
b. Transportation Requirements	Vehicle mounted	Vehicles pull trailer mounted searchlight and generator.
c. Power source	Vehicle, 24-28 VDC, 180 Amp system.	Generator 10, 15, 20 or 25 KW, 120/208V, 3 phase, 400 hertz 4 wire

Notes:

1. Testing of Xenon searchlights has not been completed. Data above is based on limited testing and will be revised as more definitive information becomes available. Ranges listed are for planning purposes and are valid to ranges shown under conditions noted below.

a. Ranges beyond 7500 meters have not been tested and may be exceeded under certain conditions.

b. Range varies depending on generator used with 30-inch searchlight.

c. Data provided is for employment of a single searchlight. Using two searchlights increases effectiveness by 50 percent.

d. Use of "Pink" light range filters have increased IR range capabilities, however, the filters allow some visible light to be emitted which may be seen at distances up to 800 meters. Care must be taken when using "Pink" filters to preclude disclosure of friendly positions.

2. Ranges listed are estimated and may be exceeded under proper conditions.

the beam, may provide concealment for enemy troops. The shadow effect can be minimized by using two or more searchlights spaced laterally and directed into the same general area. Objects silhouetted between a flank observer and the cone of light are clearly visible for several hundred meters.

b. Accuracy of fire is improved by direct illumination of the target area. Direct fire weapons can be fired into the lighted area with an accuracy approaching that obtained in daylight operation.

c. Direct observation of the light source dazzles an observer within the beam, causing temporary night blindness. Either a continuous beam or intermittent flashes can be used to cause loss of night vision among enemy troops. For an observer in the beam, observation of objects toward the light source is extremely limited, even with the eyes shaded. Additionally, it is difficult for an observer so located to estimate the range to the searchlight. Personnel within 1000 meters of the 30-inch Xenon light may receive retinal damage when looking directly at the beam.

6-3. Capabilities of Direct Illumination

Direct illumination may be employed in forward areas for varying periods of time under all but the most adverse weather conditions to—

a. Provide a flexible and an economical means of small- or large-area illumination for long periods of time.

b. Provide sufficient light in a limited area to permit aimed fire of direct fire weapons, adjustment of indirect fire, and surveillance.

c. Mark targets for close air support and for army aircraft discrete suppressive fires and other activities.

d. Illuminate the objective in the assault phase of a night attack.

e. Deny enemy infiltration or canalize enemy infiltrating groups or attacking formations into a less desirable avenue of approach.

f. Facilitate movement of troops and vehicles, construction, minefield operations, evacuation of casualties, and resupply operations.

g. Increase morale and confidence of friendly troops when they have been oriented to, and trained in, the use of illumination.

6-4. Limitations of Direct Illumination

The use of direct illumination has the following limitations:

- a. Care must be exercised in emplacement to avoid silhouetting friendly troops and installations and to obtain illumination in the desired area without creating deep shadows.
- b. Night vision of friendly troops in the vicinity may be temporarily impaired, and an illumination failure during the course of an operation may result in confusion during adjustment of the eyes to the darker condition.
- c. The searchlights may become an objective for infiltrating forces, in which case additional security elements may be required.
- d. During offensive operations, tactical surprise may be lost by the use of searchlights unless prior illumination deception has been employed.
- e. Enemy offensive and defensive operations may be benefited if friendly positions are illuminated in any manner or if relative front line locations are determined by the position of the light.
- f. Searchlights may draw enemy fire. Although this fire may be ineffective on the searchlight position, other friendly installations in the vicinity may be damaged or harassed by the fire.
- g. AM radios operating in the 1.5 to 2.5 mHz frequency range in close proximity (approximately 400 meters) to the 30-inch Xenon searchlight may receive radio interference.
- h. The effectiveness of searchlights can be reduced or sometimes nullified by the enemy's use of counter-illumination, or through the use of smoke to diffuse the light.

6-5. Uses of Intersecting or Single Beams (Direct Illumination)

A single searchlight beam or an intersection of two beams may be used to—

- a. Assist with adjustment of artillery fire.
- b. Mark terrain features or serve as a guide for patrols, raiding parties, or attacks.
- c. Signal widespread units of the commencement of a coordinated attack or similar movement.
- d. Indicate major terrain features to aid the movement of larger forces.
- e. Mark targets for high or low level aerial bombardment.
- f. Guide airborne or airmobile elements to drop zones or landing zones.
- g. Orient light aircraft in direction and location, and mark targets for army aerial fire support missions.

6-6. Factors Affecting Direct Visible Illumination

a. *General.* Searchlights employed in direct illumination may be affected by atmospheric conditions, moonlight, terrain, and enemy activity. Because these factors play a vital part in formulation of the illumination plan for any operation, plans must be kept flexible for varying conditions.

b. *Atmospheric Conditions.* On clear moonless nights, searchlights may be operated at maximum ranges. Light rain, haze, mist, smoke, or fog will decrease the effective range of the searchlight beam. Dense fog, heavy snowfall, or very heavy rain may make the searchlights ineffective. Atmospheric conditions reduce the effective range of illumination in proportion to the reduction in normal visibility.

c. *Moonlight.* Moonlight will not materially decrease the value of direct illumination, although the light intensity may appear to be less because of the reduced contrast between illuminated and nonilluminated areas. In moonlight, the visible contrast between directly illuminated and nonilluminated areas will persist to approximately one-half the usable range of the searchlight.

d. *Terrain.* Mountainous or uneven terrain presents many situations that must be overcome by deliberate reconnaissance and siting of the searchlight. This terrain may cause large shadowed areas into which the direct beam cannot be directed.

e. *Observer-Target (OT) Distance.* At night the maximum OT distance to which vehicles may be distinguished by type is approximately 4000 meters. Personnel are indistinguishable beyond 1500 meters (OT distance). Searchlights may be positioned at greater distances from the target area than the observer, but observers should always be closer than 1500 meters and 4000 meters, respectively, to detect personnel and vehicles.

f. *Aspect Angle.* Observers on the beam-target line have difficulty observing due to reflection from air particles. As the angle formed by the OT line and the beam-target line increases, this difficulty decreases until an angle of 90 degrees is attained. Angles beyond 90 degrees cause the observer to face towards the light source, resulting in glare and interference with viewing.



Figure 6-2. Illumination by diffusion.

Section II. INDIRECT ILLUMINATION

6-7 General

a. Illumination by Diffusion. Diffused illumination is obtained by directing the beam of the searchlight at a minimum elevation above the ground (fig 6-2). The area beneath and to the flanks of the beam is illuminated by the light scattered by atmospheric particles. The intensity of illumination on the ground decreases gradually as the range from the searchlight and lateral displacement from the center of the beam increase. The lower the elevation, the greater the intensity of light on the ground beneath the beam, but the width of the illuminated area to the flanks is reduced as the elevation is reduced. Best results are obtained by using a focused beam and an elevation of less than 75 mils (table 9-2). Searchlights laid at greater elevations will produce less intense illumination but over a slightly wider area, and will reduce the effective range of illumination. Hill masses and woods cast shadows in the illuminated area. Illumination in wooded areas is less intense than in open areas and the degree of intensity depends on the density of the woods. On dark clear nights, the maximum diffused illumination is approximately equal to that of the light obtained from a quarter moon.

b. Illumination by Reflection. Reflected illumination is obtained when the searchlight beam is directed against low lying (150 to 900 meters) clouds (table 9-2). The area illuminated receives light by reflection of the beam from the clouds (fig 6-3) as well as by diffusion. The area beneath the point of reflection receives a higher intensity of illumination than can be obtained from diffusion alone. Illumination equivalent to that from a full moon may be obtained from a beam reflected off low clouds. Fog, mist, or rain beneath the cloud base or a decrease in the thickness of cloud base itself will decrease the area and intensity of illumination. Best results are obtained by using a focused beam. The best cloud condition for illumination by reflection can be used satisfactorily with a minimum of 60 percent cloud coverage. Computation of the angle of elevation necessary for proper reflection onto the target area is covered in paragraph 9-11f.

6-8. Characteristics of Diffused Illumination

a. General. Diffused illumination is accomplished when the searchlight beam is directed at a low elevation over the area to be illuminated. When the elevation of the beam is 100 mils or less, deep shadows are cast forward, and

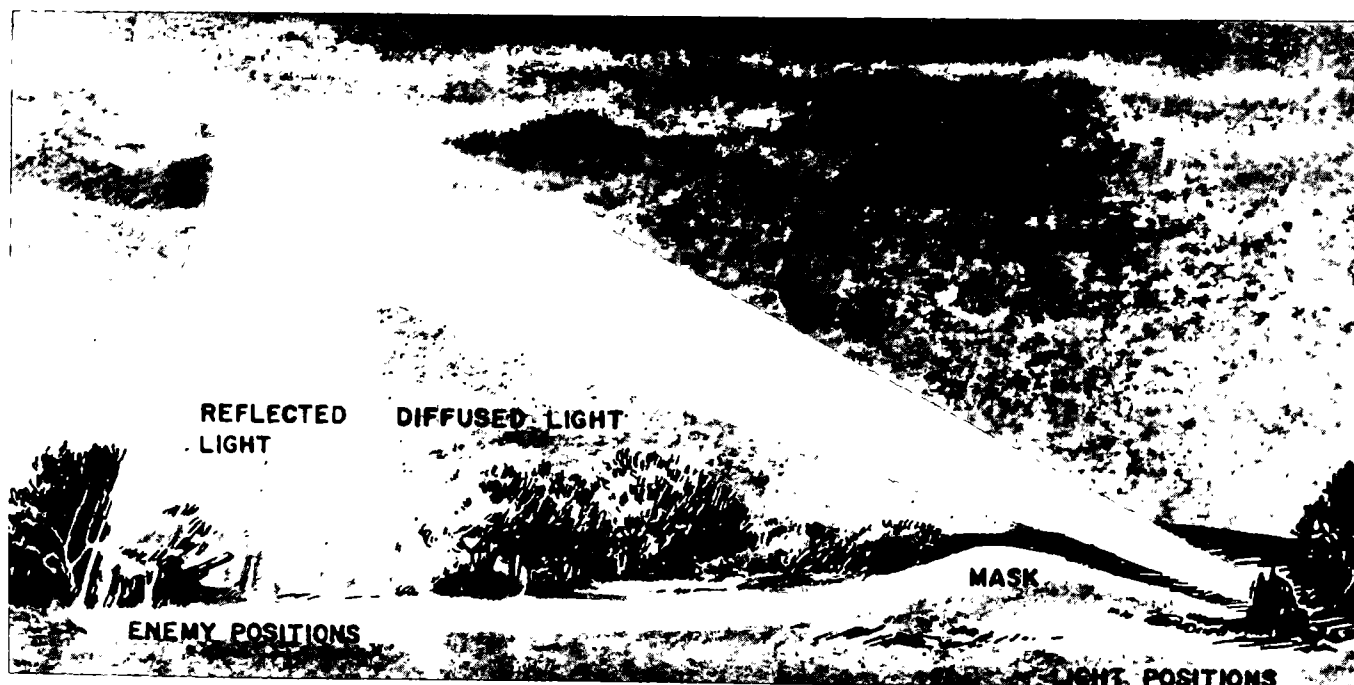


Figure 6-3. Illumination by reflection.

observation toward the source of light is difficult because of the beam glare. Elevating the beam reduces the shadow and glare effects as well as the light intensity. Diffused light illuminates hollows, draws, and tree-lined roads which ordinarily would not be illuminated to the same degree that they would by a moon low on the horizon. For the observer looking

away from the source of light, observation within areas illuminated by indirect diffused light approximates observation conditions equivalent to illumination of a quarter moon (fig 6-4). An observer *facing* the searchlights can usually see only one-third the distance seen by an observer who has his back to the searchlight (fig 6-5).



Figure 6-4. Appearance of terrain to observer looking from source of light.



Figure 6-5. Appearance of terrain to observer looking toward source of light, source hidden.

b. *Unaided Observation.* When diffused illumination is equivalent to the light of a quarter moon, an observer looking *away* from the light source may detect an object the size of a man, against a background of average contrast, at distances up to 100 meters. A light background, such as sand or water, increases observation ranges. A dark background, such as dense woods, reduces observation ranges. When an observer is looking *toward* the light source, observation is reduced to approximately 30 meters. When an object being observed is silhouetted against the light beam or against the illuminated sky, the ability to see does not increase in direct proportion to the intensity of the illumination. On a clear moonless night, a 100 percent increase in illumination may result in a

away from the light source, or (2) employs diffused illumination equivalent to the light of a quarter moon. Looking toward the light source with binoculars will aid the observer; however, the distance to which he can observe will be only one-half to one-third of that obtained when he is looking away from the light (fig 6-6).

d. *Light Intensifiers.* Observation is increased when light intensifiers are used in conjunction with diffused illumination. Range and coverage of these devices are enhanced. Intensifiers can become overloaded by intensity of diffused illumination in some cases.

e. *Adjustment of Fire.* Sighting of weapons is facilitated by diffused illumination, although

Binocular power	Light intensity equal to quarter moon	Light intensity equal to one-eighth moon
6 X 30	800 meters	600 meters
7 X 50	900 meters	700 meters

Observing ranges are only one-half to one-third of the ranges listed in the table above when observation is toward the source of light.

Figure 6-6. Observation, with binoculars, away from the source of light—diffused illumination.

like increase in observing range; but, when the equivalent light of a quarter moon is present, a 100 percent increase in illumination may result in only a 10 percent increase in observing range.

c. *Observation with Binoculars.* An observer using 6 x 30 binoculars can detect a man standing against a light background at ranges up to about 800 meters when he (1) is looking

the light is not adequate to permit aimed fire unless the sights are illuminated. Small-arms fire can be directed into specific areas when large objects can be identified. Adjustment of indirect artillery fire is about the same as adjustment of fire in the light of a quarter moon. Determination of the location of an enemy weapon is assisted materially because the flash can be located with respect to the position of

the main searchlight beam and the discernible outline of terrain features.

6-9. Characteristics of Reflected Illumination

Reflected illumination has the same general characteristics as diffused illumination. Illumination by reflection from clouds has less directional effect than illumination by diffusion because the reflecting cloud is the source of overhead illumination. The directional effect close to the searchlights is almost the same for reflected illumination as for diffused illumination. Beneath the point of reflection, there is little or no difference in observing toward or away from the searchlights. The enemy, therefore, is aided by reflected illumination to a greater degree than by diffused illumination. The sighting of weapons and the adjustment of fire are facilitated, in general, to the same degree by either reflected or diffused illumination.

6-10. Capabilities of Indirect Illumination

Indirect illumination may be employed continuously to—

- a. Provide for limited surveillance when the light source is to the rear of the observer.
- b. Provide direction for friendly elements and activities such as patrols and raiding parties.
- c. Support direct or indirect fire.
- d. Facilitate movement of troops, transport, resupply, evacuation of casualties, and movement into and out of positions.

e. Assist in defensive operations such as minelaying and the construction of barriers, and in hampering enemy air observation.

f. Enhance observation when light intensification devices are used in areas of reflected light.

6-11. Limitations of Indirect Illumination

In addition to the limitations of direct illumination listed in paragraph 6-4, the use of indirect illumination has the additional limitation of reducing friendly air observation by screening. The blanket of light over the target area limits observation through it into the area below.

6-12. Factors Affecting Indirect Illumination

a. *General.* Indirect illumination is influenced by the same factors that affect direct illumination, though not necessarily in the same manner.

b. *Atmospheric Conditions.* Light rain, haze, mist, smoke, or fog increase illumination by diffusion at midranges. However, extremes of these conditions may result in ineffective indirect illumination.

c. *Moonlight.* On a clear night when the moon is full, indirect illumination does not increase visibility unless the moon is low on the horizon.

d. *Terrain.* Indirect illumination by the searchlight generally has the same capability as direct illumination in mountainous or uneven terrain. The intensity and the quality of illumination vary with the texture and color of the terrain surface.

Section III. INFRARED OPERATIONS

6-13. General

The Xenon family of searchlights provides an infrared capability when either infrared or "Pink" filters are used. "Pink" filters allow some visible light to pass that is just below the infrared light frequency spectrum. This visible light in the pink frequency range cannot be seen if the observer is more than 800 meters away from the source. Infrared viewing equipment must be available for observers (FM 20-60).

6-14. Characteristics of Infrared Illumination

Filters which allow passage of near infrared light frequencies are placed over the light source. These filters reduce the range of the searchlight considerably as shown in table 6-1. The critical distance is not how far away the searchlight is, but how far the observer is from the target. Effective range of the searchlight can be increased by forward positioning of observers. The viewing device used by ground

observers will determine the effective range achieved. For most artillery purposes, the crew-served weapon sight is preferred for ground observation. Air observers prefer the M-18 infrared binoculars. Moving targets are easy to detect with IR illumination. Flares do not flood out or adversely affect infrared devices unless the flare is within the field of view. An enemy equipped with infrared viewing devices can quickly identify infrared emitters and may locate the source accurately by intersection survey. An enemy looking into the source with an IR viewer receives glare comparable to that of high beam headlights of an automobile.

6-15. Capabilities of Infrared Illumination

The capabilities of infrared illumination are greater when used against an enemy who is not equipped with infrared devices. This type of illumination does not cause loss of night

vision for any significant period. Infrared illumination may be employed as follows:

a. *Enemy not equipped with infrared viewing devices.*

(1) Provide undetected surveillance of critical avenues of approach.

(2) Assist aimed fire by the attacking or defending forces.

(3) Surprise enemy forces when used with automatic weapons systems in coordinated operations.

(4) Sweep area with IR illumination continuously to assist reconnaissance or ambush patrols or other offensive and defensive ground operations.

(5) Illuminate object areas or targets without alerting enemy forces.

b. *Enemy equipped with infrared viewing devices.*

(1) Deceive the enemy as to operations in the area.

(2) Overload the enemy's IR viewers.

6-16. Limitations of IR Illumination

IR illumination requires infrared viewers that may not be available in the quantities required. IR emitters may disclose friendly positions when the enemy is equipped with IR viewers. Range of IR emitters is considerably less than that for visible illuminators, although observers can be positioned closer to the desired target

areas. Indirect IR illumination is not considered practical. Additionally, the effectiveness of IR illumination can be reduced through appropriate countermeasure techniques such as counter-illumination, smoke, or the deliberate placement of simulated objects. (See FM 31-40 and FM 32-20.)

6-17. Planning and Employment Considerations

a. The enemy's IR detection capability is the principal consideration in employment and planning. The use of IR provides the commander with great flexibility when the enemy's detection capability is limited. The focused beam should be used for all IR operations. Operations can be planned with both IR and visible light. These operations must be well coordinated because some IR viewers may be overloaded if subjected to visible light. Procedures for planning are contained in chapter 7. At night, when other missions are not in progress, and provided no restrictions are imposed, searchlights will operate in the infrared mode.

b. Night searchlight operations can be enhanced by the integrated use of night vision devices. The capabilities of the night vision devices are expanded by the searchlights operating in the semi-covert mode by increasing the range and image clarity.

Section IV. OTHER OPERATIONS

6-18. Illumination in Rear Areas

The versatility of searchlight employment in rear areas is limited only by the commander's ingenuity and imagination. Searchlights can be used in rear areas to illuminate road nets and supply routes; to facilitate the unloading and classification of supplies on beachheads, or at ports or depots; and to facilitate the construction of bridges, airfields, and other facilities. For general illumination over large areas, indirect illumination techniques are used. For specific illumination of small local areas or job sites, either indirect or direct illumination may be used.

6-19. Methods of Employment

a. *Illumination of Job Sites.* When searchlights are used to illuminate job sites, the lens can be covered by material such as bed sheets, mattress covers, or target cloth, or the beams may be reflected off walls, trees, or artificial screens. Direct illumination by means of a covered searchlight is best, but the possibility of fire from the intense heat of the light should be considered. Job-site illumination by reflection

from water surfaces or metallic reflectors has serious glare effects that may interfere with the operation of the working party. Damage to the eye retina of personnel within 1000 meters of the 30-inch searchlight may result if the direct beam illumination method is employed. When a single searchlight is employed and the system of reflecting the light is used, deep shadows are cast by the light. The use of two or more searchlights will eliminate most shadows.

b. *Illumination of Road Nets and Rear Areas.* When searchlights are used to illuminate road nets and rear areas, the best results are obtained by indirect illumination. Direct illumination should be avoided in these areas. Particular care must be taken in sighting the searchlights along a road in order to avoid dazzling the drivers of motor vehicles. In general, the searchlights should be located so that the light forms a cone over the area to be illuminated.

c. *Illumination in Support of Psychological Operations.* When searchlights are employed to support psychological operations, illumination missions may be conducted to attract attention

tion to loudspeaker broadcasts or leaflet drops, and for harassment of insurgent forces. Other psychological operations which may include the employment of searchlights are discussed in FM 100-20, FM 31-16, FM 31-21, FM 31-36 (Test), FM 33-1, and FM 33-5.

d. Illumination in Support of Military Civic Action. Searchlight units may be employed to

provide illumination for civic action projects. For additional details on military civic action, see FM 100-20, FM 31-22, FM 31-73, and FM 41-10.

e. Additional Information. Additional guidance regarding stability operations may be found in FM 6-20-1, FM 100-20, FM 100-5, FM 31-16, FM 31-22, FM 31-23, and FM 19-50.



CHAPTER 7

ILLUMINATION PLANNING

Section I. GENERAL

7-1. General

a. Echelons of Planning. Illumination planning is accomplished at all echelons of command and may originate at any echelon. Target acquisition is performed by all target locating agencies. The same artillery channels and coordination procedures used in conventional fire planning are used in illumination planning.

b. Sequence of planning. Illumination planning is continuous. It starts upon receipt of the mission of the supported unit and is conducted concurrently with artillery fire planning.

c. Principles of Illumination Planning. The principles of illumination planning are as follows:

(1) Highest echelon possible provides illumination to conserve means available to lower echelons.

(2) Sufficient light must be provided to assist friendly forces in the conduct of operations at night and, where possible, to deny any advantage to the enemy.

(3) Continuous support must be provided the attacking or defending forces at night.

(4) Coordination must be accomplished with the supported unit, with adjacent units, and with supporting artillery, naval gunfire, and tactical aircraft to insure that planned illumination will not adversely affect such units.

(5) Illumination must be consistent with the situation.

(6) Illumination planning must be continuous.

(7) Infrared illumination and viewing capability of the enemy must be considered.

(8) Searchlight operations are integrated with other illumination or surveillance sources.

7-2. Target Acquisition

Any agency may request illumination of an area. The location of the area and duration of the illumination must be specified in the request. Personnel will not be employed solely to locate targets suitable for illumination. Artillery staffs at all levels are responsible for processing information relating to critical areas that require illumination. All target locations are examined with illumination requirements in mind. IR illumination provides a greater

potential for target acquisition unless the enemy is equipped with IR viewers.

7-3. Target Analysis

Each potential target for illumination must be analyzed by the planner to determine its military importance, the necessity for illumination, its relative priority for illumination, and the capabilities of available illuminants for such illumination. In making his target analysis, the illumination planner will employ those techniques outlined in Fm 6-20-2.

7-4. Employment of Battlefield Illumination Means

The illumination planner has three principal means of illuminating the battlefield: Searchlights (visible and IR light), artillery and mortar illuminating shells, and aircraft flares. The following criteria are used to determine the means of illumination to be employed on a specific target:

a. Duration. When illumination of long duration is planned, searchlights should be used. The available ammunition supply and the factors affecting the resupply rate will limit illumination by mortar or artillery shell, while the availability of aircraft and/or flares will limit illumination by aircraft flares. Searchlights can illuminate almost continuously except for about 5 minutes during each 4 hours of continuous operation for refueling the generator. Artillery and mortar illuminating shells illuminate from 1 to 2 minutes. Continuous illumination can be provided by any of the means but is most economically accomplished with searchlights.

b. Intensity. The intensity of light required on the target must also be considered in selecting the means of illumination. When a soft diffused light is required, indirect lighting by searchlights may be used. Direct illumination by searchlights, illuminating shells, or aircraft flares may be used when a greater intensity is required. Covert activities are effective under IR illumination when the enemy lacks or has limited IR detection equipment.

c. Shadows. Direct illumination by one searchlight provides steady, intense illumina-

tion, causing exaggerated shadows in which target detection is difficult. Aircraft flares and illuminating shells employ a flare suspended from a parachute. This flare may swing like a pendulum, causing the ground shadows to move and make target detection difficult. Shadow effects of both flares and searchlights can be minimized by multiple light sources, such as two or more flares and/or two or more searchlights employed simultaneously. Indirect reflected illumination by a searchlight, though of an intensity approaching full moonlight below the point of reflection, provides a softly shadowed area of illumination. Range of image intensifier can be enhanced under these conditions.

d. Accuracy. A searchlight beam adjusted on a target area will remain accurately placed until moved and, if moved, can be accurately returned to the same target area. Aircraft flares are difficult to adjust, and successive flares dropped from approximately the same altitude will differ in accuracy on the target because of wind drift and differences in the flare parachutes (FM 20-60). Illuminating shells are affected by the weather to the same extent as are other artillery projectiles; their points of burst can be predicted with accuracy. However, as with aircraft flares, differences in effect on the target may be caused by variations in the functioning of the flare parachutes and with wind conditions in the target area.

e. Effect on Adjacent Units. Illumination cannot ordinarily be confined to a specific area. Direct searchlight illumination is the most easily controlled of all illuminating means. Wind caused drift and the height of burst affect the size of the area illuminated by an aircraft flare or illuminating shell. Care must be taken to avoid illuminating adjacent units' areas which may adversely affect the accomplishment of the adjacent units' missions. Radio frequency interference in the AM band between 1.5 and 2.5 mHz may be caused by 30-inch Xenon searchlights operating in proximity to the radios.

Section II. ILLUMINATION SUPPORT PLAN

7-6. Illumination Support Plan

The illumination support plan is normally prepared at the division artillery fire direction center; it is based upon requests of supported units, or prepared on an as directed basis, and is published as an appendix to the division fire support annex. Coordination is accomplished at corps to insure integration of battlefield illumination with fire support means and

f. Availability of Other Means. The use of illuminating shells may be limited by the available supply or the nonavailability of transportation required to carry the ammunition forward. The use of aircraft flares may be limited by the effect of weather on the aircraft flight; consequently, they are not suitable for all-weather delivery. The searchlight will generally be limited only by the availability of suitable position areas. An inspection of the searchlight unit's visibility diagrams will indicate the fields of direct illumination possible from available positions.

7-5. Factors Affecting Battlefield Illumination

Certain external factors affect the efficiency of searchlight illumination (para 7-4). If, in consideration of these factors, searchlight illumination proves impracticable, aircraft flares or illuminating shells may be used. The following factors must be considered in planning battlefield illumination:

a. Weather. Information of anticipated weather conditions must be obtained from appropriate weather sources. Weather forecasts are studied to aid in determining the best means of illumination. Cloud conditions are particularly important in planning indirect searchlight illumination by reflection.

b. Terrain. Map studies (and studies of visibility diagrams for direct illumination) accompanied by ground reconnaissance, whenever possible, are necessary to determine the suitability of searchlight positions for the fulfillment of the assigned mission.

c. Moonlight. The phase and position of the moon during periods of illumination can be determined from the current TM 6-300-series, the Army Ephemeris, or from other ephemerides and almanacs. Higher headquarters and air weather detachments can frequently provide such data.

d. Availability of Night Viewing Devices. The availability of night viewing devices will influence the amount and type of illumination needed.

to coordinate the use of all means of illumination. The illumination support plan (fig 7-1) may consist of any or all of the elements in *a* through *d* below. The degree of completeness is contingent on the amount of time available. The planning procedures outlined in FM 6-20-2 are followed in the presentation of these elements.

a. Written Portion. The written portion pro-

Copy Number 2
1st Inf Div
Vicinity 37501181
100100 April 1970
MX 305

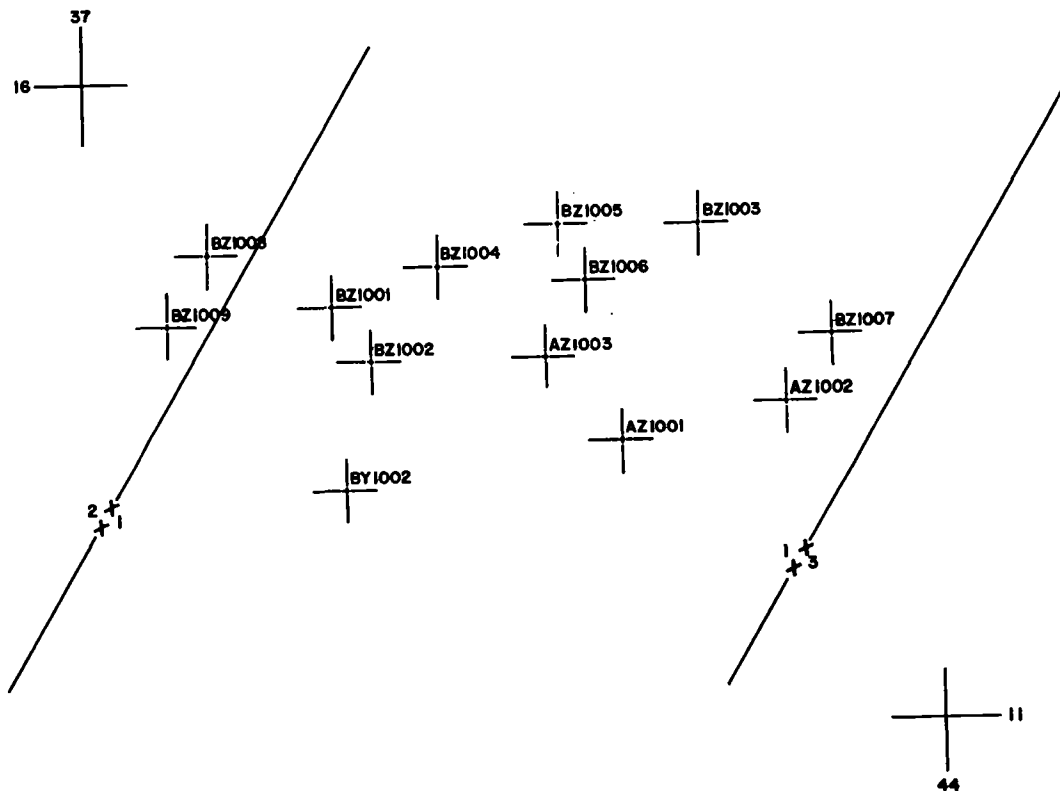
Appendix 5 (Illumination Plan) to Annex C (Fire Support Plan)
To OPORD 12
Maps: US 1:50,000, FORT SILL, MT SCOTT

1. 1st and 2d Brigade will attack abreast, 2d Brigade on the north, 3d Brigade reserve.
2. Priority of illumination to the 2d Brigade.
3. Targets in 2d Inf Div area as shown will be illuminated.
4. Infrared illumination until H-2, visible light until termination by supported Brigade.

Acknowledge.

Distribution: A COGGINS
OFFICIAL: Maj Gen

/s/ Oinwiddle
OINW1001E
G3



ILLUMINATION TARGET LIST

Target Number	Description of Target	Coordinates	Altitude	Size	Source	Remarks
AZ1001	Road Junction	41371342	340	200	PI	SLT (IR)
AZ1002	Avenue of Approach	42831362	250	400	PI	SLT (IR & Direct)
AZ1003	Entrenchment	40811396	400	50	AO	SLT (IR and Direct)
BY1002	Suspect OP	39111286	405	50	PI	SLT
BZ1001	Suspect CP	39051430	395	200	PI	SLT
BZ1002	Avenue of Approach	39281398	380	400	PI	Illuminating Shell
BZ1003	Suspect CP	41961460	385	200	PI	SLT (IR & Direct)

UNIT		SCHEDULE OF ILLUMINATION									
		-10	-8	-6	-4	-2	H	+2	+4	+6	
BTRY 0 1st ARTY (SLT)	1-1					BZ1001					
	1-2								AZ1002		
	1-3			AZ1001					AZ1003		
	1-4					BZ1002					
	1-5					BZ1002					
	1-6					BZ1003					
	2-1										
1st BN 10th ARTY	Btry A										
									AZ1001		

Figure 7-1. Illumination support plan.

vides the who, what, where, when, and how information that is not shown graphically. No standard number of paragraphs or sequence of information is prescribed for the written portion. Commencement and termination of infrared or visible light are included in this portion.

b. Graphic Portion. There is no substantial difference between the graphic portion in the illumination support plan and the corresponding portion of the artillery fire support appendix as outlined in FM 6-20-2. This method applies to all targets designated as solely illumination targets. However, conventional artillery targets are also used to compute illumination data. Shown within this portion is such information as—

(1) The location of targets, depicted by tick marks and identified by the appropriate designation.

(2) Coordinating and limiting measures.

(3) Groups of targets to cover single areas too large to be covered by one target.

c. Illumination Target Listing.

(1) *Visible light requirements.* All targets shown in the graphical portion will be shown in the illumination target listing. All targets listed are available to be illuminated on call. Targets are usually described as the diameter of a circle in meters.

(2) *Infrared illumination requirements.* All infrared targets will be designated appropriately.

d. Schedule of Illumination. The unit designated to provide the illumination and the duration of the illumination are included in the schedule of illumination. All scheduled illumination is listed. Illumination by artillery illuminating shell will be listed both on the schedule

of illumination and on the artillery schedule of fires. The method of constructing this schedule is outlined in FM 6-20-2.

7-7. Planned Illumination and Targets of Opportunity

a. General. As with fire planning, illumination planning is continuous. The detail with which illumination planning is conducted depends on the time available for planning, the extent and accuracy of target locations, the type of operation in which the supported unit is engaged, the illumination requirements of higher echelons, and the means of illumination available.

b. Definitions. The following terms are used in illumination planning and should be understood by illumination planners:

(1) *Scheduled illumination.* Scheduled illumination is that illumination which is planned both as to location and time. It is generally scheduled to fit a particular plan of maneuver.

(2) *On-call illumination.* On-call illumination is that which is planned as to location but not as to time. It is generally planned for areas in which illumination requests are anticipated but in which scheduled illumination is neither practicable nor desired.

(3) *Targets of opportunity.* Targets for which illumination is not planned are known as targets of opportunity. These areas may be illuminated on request from commanders of units in contact, observers, or any target locating agency. Requests for illumination may also be submitted in conjunction with requests for adjustment of artillery fires or other weapons.

CHAPTER 8

ADJUSTMENT OF ILLUMINATION

8-1. General

The procedure used by a forward observer in requesting a searchlight illumination mission and in adjusting the searchlight beam on a specific target is similar to the procedure used in adjusting artillery fire. Although some of the elements of an illumination request are different from those of a fire request, the sequence and descriptive wording parallel the form of the fire request.

8-2. Illumination Request

a. Elements of the Illumination Request.

Element	Example
Identification of observer	THIS IS NOBLE DELTA 44.
Warning order	ILLUMINATION MISSION.
Reference point or grid coordinates	FROM TARGET AB4001.
Azimuth from observer to target	DIRECTION 4820.
Shift	RIGHT 400, ADD 700.
Nature of target	SUSPECTED PATROL.
Type of adjustment	TWO LIGHTS.
Type of illumination	DIRECT (INDIRECT) (IR).
Beam spread	PENCIL BEAM.
Control	ADJUST LIGHT OR, AT MY COMMAND FLICK.

b. *Identification of Observer.* The observer identifies himself to the unit from which he is requesting illumination by appropriate call signs or code.

c. *Warning Order.* The observer sends ILLUMINATION MISSION to alert the light direction center. The warning order indicates that a request for illumination follows.

d. Location of Target.

(1) *Reference point or coordinates.* The location of the target may be given as a shift from a known point, by grid coordinates, or by polar coordinates.

(2) *Azimuth from observer to target.* The observer determines the azimuth from his position to the target by the use of a compass or other angle-measuring instrument, or a map. When no angle measuring instrument is available, the observer estimates the azimuth.

(3) *Shift.* The observer may shift from a known point, which may be a registration point, a numbered artillery or illumination target,

or he may shift from any other point the chart location of which is known at the LDC. The shift is given as corrections in meters, usually to the nearest 10 meters.

e. *Nature of Target.* The nature of the target consists of a brief description of the enemy installation, personnel, equipment, or activity observed. The nature of the target is preceded by the word SUSPECTED if positive identification of the target cannot be made.

f. *Type of Adjustment.* The number of searchlights desired on a particular mission is specified in the type of adjustment requested. If the type of adjustment is omitted, one searchlight will be used in adjustment.

g. *Type of Illumination.* The observer can request direct or indirect illumination. If the type of illumination is omitted, direct illumination will be used. Infrared may be requested.

h. *Beam Spread.* The observer requests the beam spread necessary to illuminate the area under observation. The beam spread is designated as pencil or spread beam. If the type of beam spread is omitted, a pencil beam will be used.

i. *Control.* The observer's designation of control may be announced as ADJUST LIGHT, which indicates that subsequent adjustments of the initial beam will follow or AT MY COMMAND, which indicates that the illumination is required at a specific instant. The command AT MY COMMAND must be followed by the subsequent command FLICK at the actual time the observer is ready to observe.

8-3. Examples of Illumination Requests

a. Example 1.

THIS IS NOBLE DELTA 44.
ILLUMINATION MISSION.
GRID 386489.
DIRECTION 1240.
SUSPECTED AUTOMATIC WEAPONS.
ADJUST LIGHT.

b. Example 2.

THIS IS NOBLE DELTA 44.
ILLUMINATION MISSION.
FROM TARGET AE4001.
DIRECTION 1600.
RIGHT 200, ADD 600, UP 20.
SUSPECTED PATROL.

INFRARED. ADJUST LIGHT.

8-4. Information Sent to Observer

a. If the target is to be illuminated, the light direction center furnishes the following information to the observer:

<i>Element</i>	<i>Example</i>
Searchlight(s) illuminating ...	NUMBER 3.
Type of illumination	DIRECT.
Target number	BZ1008.

b. If the target is not to be illuminated, the observer is notified WILL NOT ILLUMINATE.

c. When the observer has sent AT MY COMMAND, the light direction center transmits READY to indicate that the searchlights are ready to illuminate. The illumination is then provided on the observer's transmission of FLICK.

8-5. Subsequent Corrections

The observer makes all corrections in azimuth and elevation with reference to the searchlight-target line. When two searchlights are being used, each is adjusted individually. The only elements announced are those corrected. The omission of either an azimuth or elevation shift indicates that the element is to remain the same. If the observer desires to change the width of the beam spread, he commands INCREASE (REDUCE) BEAM SPREAD. This correction precedes the azimuth and elevation corrections. The azimuth and elevation corrections can be determined by either of the methods in *a* and *b* below.

a. *Beam Width Method.* In the beam width

method, the width used is the diameter of the searchlight beam as viewed by the observer in the target area. The beam width varies with the range and width of beam spread, but, regardless of its size, a shift of one beam width will move the center of the illuminated area the width of the beam being used. Using the width of the searchlight beam as a unit of measure, the observer commands LEFT (RIGHT) (so many) BEAM WIDTHS, UP (DOWN) (so many) BEAM WIDTHS. The smallest correction given is LEFT (RIGHT) ONE-FOURTH BEAM or UP (DOWN) ONE-FOURTH BEAM.

b. *Shift in Meters Method.* In the shift in meters method, the observer determines a shift in the same manner as for the adjustment of artillery fire on the gun-target line. The smallest correction in meters which can be made by the observer is 10 meters.

c. *Sweep Method.* On occasion, the observer or the searchlight crew may desire a continuous sweep or a sweep in one direction of the searchlight beam. This may be used in visible or infrared mode; however, infrared is the normal mode in which the sweep is used. The observer commands SWEEP SECTOR, SWEEP RIGHT (LEFT), or CONTINUOUS SWEEP. Visible light is rarely employed in this manner because potential targets can normally hide or conceal their locations as the light approaches. Infrared illumination may be employed in this manner unless the enemy is equipped with IR viewers. Continuous sweep requires the searchlight crew to observe the sweep, keeping the light on the terrain in a manner which best uses the infrared illumination.

CHAPTER 9

LIGHT DIRECTION

Section I. GENERAL

9-1. Principles

Light direction center (LDC) functions parallel those of the fire direction center (FDC) of an artillery battalion. A searchlight chart is prepared showing each searchlight position, the illumination capability of each searchlight, the zone of action, and areas where light targets are desired. Illumination requests are received from target locating agencies and illumination plans. These requests are processed and data are computed for the illumination mission. The decision to illuminate is made at the division artillery FDC. The corps commander's concurrence is required whenever adjacent units may be affected.

9-2. Functions

The light direction center is prepared to direct searchlights on an area when illumination is requested. The light direction center will—

- a. Maintain for each searchlight a record of the minimum elevations, capabilities, and probable time of refueling the generator.
- b. Prepare data for various light missions on possible targets based on the illumination plan and intelligence received from corps artillery and other sources.
- c. Direct the relief of a searchlight that must go out of action for any reason.

- d. Control the sequence and time of illumination by searchlights.

9-3. Level of Operation

a. Each platoon establishes a light direction center in the vicinity of the supported division artillery's fire direction center. All searchlight data is produced at the platoon light direction center. When searchlights are operated in rear areas, such as in job-site illumination, a light direction center is not necessary and control may be decentralized down to the individual searchlight sections.

b. A capabilities chart is maintained at the battery command post. This chart is the basis for the battery commander's advice on illumination matters.

9-4. Physical Arrangement of the Light Direction Center

a. The light direction center may be located in a tent, in the back of a truck, in a house, or in any other suitable location. The light direction center is located in the vicinity of the supported unit's artillery fire direction center. The location must provide sufficient working space and protection from the elements and enemy action.

b. Figure 9-1 depicts the layout of a typical light direction center. Duty posts of personnel are indicated thereon.

Section II. LIGHT DIRECTION CENTER OPERATION

9-5. Preparation of Data

Data for delivering searchlight illumination is computed at the platoon light direction center. Data for scheduled and on call missions are prepared immediately upon receipt of the approved illumination plan. Data for areas in which illumination requests are anticipated should be computed as far in advance as possible.

9-6. Sources of Target Information

Targets to be illuminated by searchlights may be located and reported by supported units,

by artillery liaison personnel with those units, by field artillery ground or air observers, by personnel of the field artillery target acquisition battalion (sound, flash, and radar), and by adjacent or higher headquarters. Targets may also be located by analyzing photographs and by knowing the enemy's activities. A tentative description of the target should accompany the report; a request for fire and/or illumination may also accompany the report. If the report is to be of maximum value, it must be transmitted promptly.

9-7. Target Location

Target locations may be pointed out on the

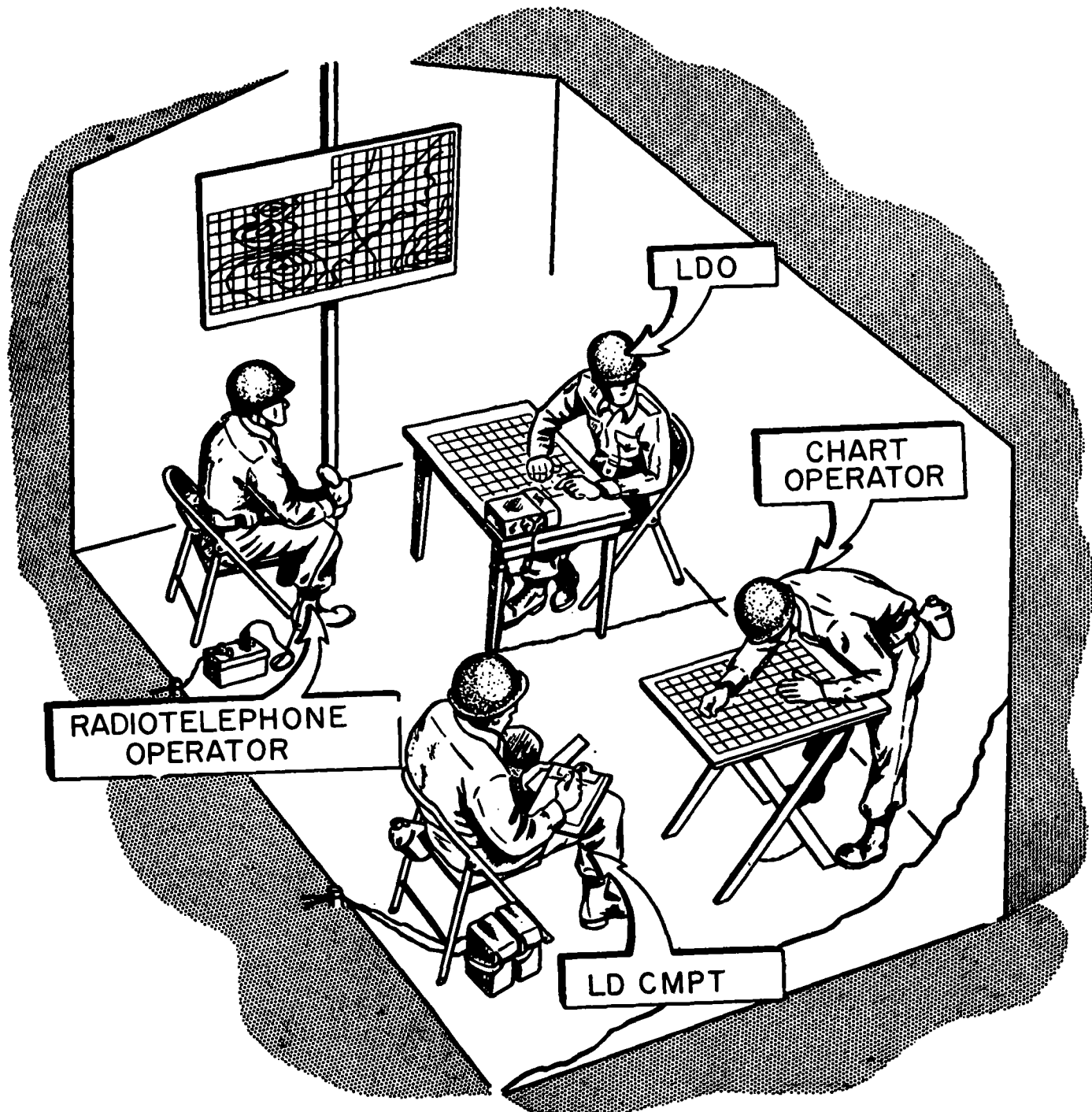


Figure 9-1. Light direction center.

ground, designated by grid coordinates, designated by reference to a known point (such as a target previously illuminated or fired upon), designated by azimuth and range from an ob-

servation post, marked on maps or photographs, or traced on overlays of such maps or photographs.

Section III. DUTIES OF LIGHT DIRECTION CENTER PERSONNEL

9-8. General

The personnel of the light direction center are assigned specific duties, which are performed in a prescribed sequence and manner in order to provide efficient control.

9-9. Duties of the Light Direction Officer

a. *General.* The platoon commander, or the assistant platoon commander, acts as the light direction officer. He plans, coordinates, and supervises the activities of the light direction

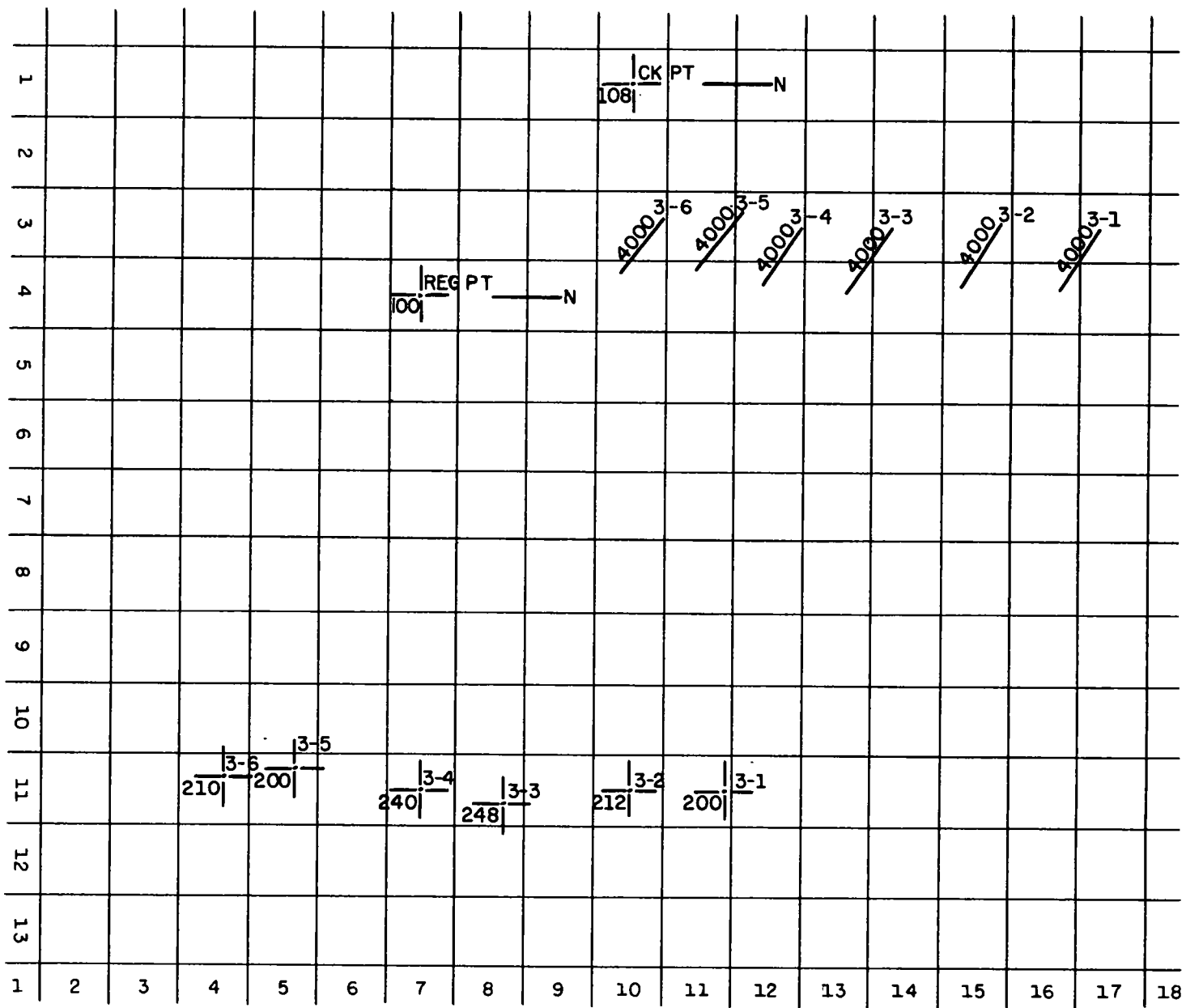


Figure 9-2. A light direction chart.

center and is responsible for the training of the personnel of the platoon.

b. Decision to Illuminate. The decision to illuminate will usually be made at the highest headquarters concerned. If all available searchlights are performing an illumination mission and an additional request for illumination is received, the light direction officer will refer the request to the S3 of the supported unit for an alternate means of illumination or for approval for termination of a searchlight mission already in progress to make a searchlight available.

c. Illumination Order. The light direction officer issues an illumination order upon receipt of an illumination mission. The order may consist of all or a portion of the elements in (1) through (5) below. These elements are sent to the observer conducting the mission for information and future reference. Considerations affecting these elements are discussed in *d* through *h* below.

Element	Example
(1) Number and designation of searchlights.	NUMBER 3.
(2) Type of illumination.....	DIRECT.
(3) Beam spread	PENCIL.
(4) Control of illumination ...	WHEN READY.
(5) Target number	TARGET BZ1008.

d. Number and Designation of Searchlights. The decision as to which searchlight(s) will conduct the mission depends on the—

- (1) Number of searchlights available.
- (2) Size of the area to be covered and the accuracy of its location.
- (3) Advisability of surprise illumination.
- (4) Importance of the target.
- (5) Angle T (should be not less than 100 mils for best observation when direct illumination is employed).

e. Type of Illumination. The type of illumination will depend on the intensity of illumination desired and the location of the searchlights in relation to the target area. If direct illumination is to be furnished, due consideration must be given to the enemy's countermeasure and infrared capabilities.

f. Beam Spread. The beam spread used for direct illumination depends on the searchlight target range. The pencil beam provides the most usable range whereas the spread beam provides a greater area of coverage but a resultant decrease in intensity and range. In general, the pencil beam is used for indirect illumination.

g. Control of Illumination. The mission and effect desired govern the selection of illumination control, such as WHEN READY, TIME-ON-TARGET (TOT) (either with or without ac-

companying artillery fire), AT MY COMMAND, or any specified time according to a prearranged schedule.

h. Target Number. The target numbers assigned by the light direction officer are allotted by corps artillery to the searchlight battery just as for any other corps artillery unit. Illumination target numbers assigned by illumination planners at other echelons are selected from their ordinary artillery block of numbers.

9-10. Duties of the Chart Operator

a. Constructs the Light Direction Chart. The chart operator is a key member of the light direction center. He prepares and operates the light direction chart. The chart operator plots the searchlight positions on the light direction chart and maintains other information on the chart which may be of particular importance, such as the capabilities of each light, locations of friendly elements and observers, and limiting factors such as *areas not to be illuminated*. Because of the frequent change in these items of information, it may be more convenient to keep them on an overlay to the light direction chart. Figure 9-2 is an example chart. See FM 6-40 for a detailed discussion of plotting.

b. Operates the Target Grid. The target grid is a device for converting the observer's target locations pertaining to the observer-target (OT) line to target locations with respect to the searchlight-target line (fig 9-3). The chart operator uses a target grid in conjunction with the light direction chart. For a detailed discussion of the use of the target grid, see FM 6-40.

c. Constructs Azimuth Indexes. The chart operator constructs azimuth indexes for the zone of responsibility of each searchlight as outlined in FM 6-40. These indexes are marked with their proper values and identified by the section and platoon designations.

d. Plots Targets. The chart operator plots all targets reported to the light direction center. Targets reported by coordinates are plotted by using the coordinate scale. To plot targets designated with respect to a reference point, the chart operator first orients the target grid. The chart operator then moves the plotting pin right or left (so much) along a line perpendicular to the arrow on the grid and adds or drops (so much) along the directional arrow or one of the lines parallel to it. In this manner, the target is plotted with respect to the OT line. For a detailed discussion concerning the plotting of targets, see FM 6-40.

e. Determines and Announces Data. After completing the target plot, the chart operator places the vertex of the range-deflection pro-

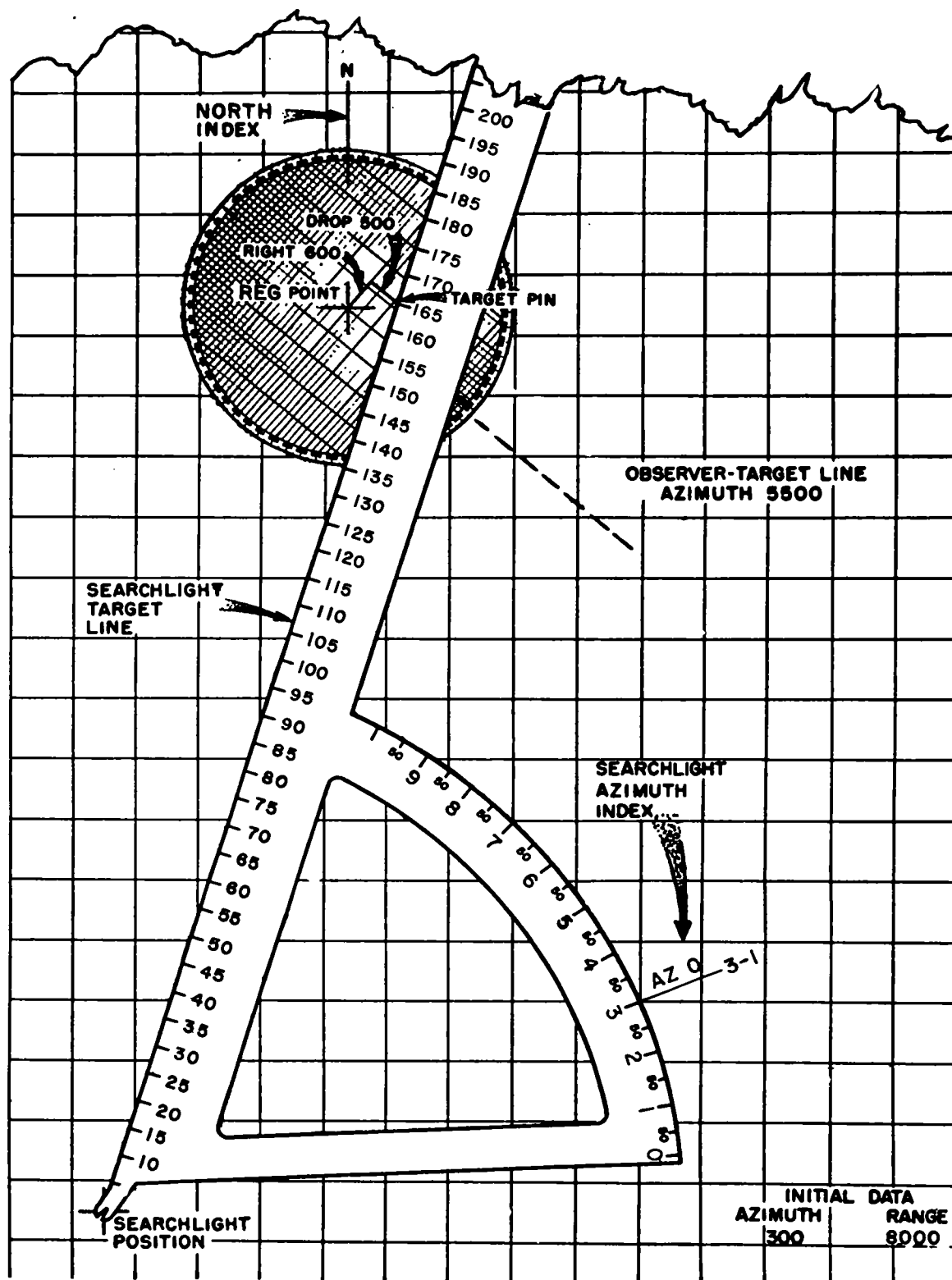


Figure 9-3. Light direction chart operations.

tractor at the pin marking the searchlight position and places the range scales of the range-deflection protractor against the plotting pin marking the target location. Data are read and announced in the following sequence: *azimuth*, *range*, and *altitude*. The chart operator reads

and announces only the data for the initial plot for the illumination mission. The computer processes all subsequent shifts. After the chart operator has announced the azimuth, range, and altitude for the initial plot, he is free to process another mission.

f. Announces Azimuth. The chart operator reads the azimuth for the searchlight from the deflection scale of the range-deflection protractor opposite one of the azimuth indexes for that searchlight and announces it to the computer. When the azimuth is announced to the computer, it is preceded by the word AZIMUTH: for example, NUMBER 3, AZIMUTH 300.

g. Announces Range. The chart operator reads the range for the searchlight or searchlights from the range scale of the range-deflection protractor opposite the target plotting pin and announces it to the computer. The range is announced immediately after the azimuth and always is preceded by the word RANGE: for example, NUMBER 3, AZIMUTH 300, RANGE 8300. Range is rounded to the nearest 100 meters.

h. Announces Altitude. The altitude of the target is determined in one of several ways—it may be read from the light direction chart, if the chart is a battle map; it may be computed when the observer shifts from a known point (the shift up or down is applied to the altitude of the known point); or it may be assumed to be the same as the altitude of the known point when no shift up or down is made. Altitude is expressed in meters. The chart operator announces the altitude immediately after the azimuth and range. The altitude is always preceded by the word ALTITUDE and followed by the unit of measure; for example, NUMBER 3, AZIMUTH 300, RANGE 8300, ALTITUDE 155 METERS.

9-11. Duties of the Computer

a. General. The computer is also a key member of the light direction center. He must accurately and rapidly convert the light direction officer's illumination order, the chart data, and the observers' corrections into commands and transmit the commands to the searchlights. The computer should be trained to perform the duties of the chart operator.

b. Alerts the Searchlights. The computer alerts the searchlight(s) as soon as the mission is received. Commands are sent as rapidly as they are determined; it is not necessary to send all elements of a command in one transmission. The computer repeats all data received from the light direction officer and the chart operator and records the data in the computer's record.

c. Records LDC Data. The computer records the—

(1) Illumination missions reported to the light direction officer.

(2) Light direction officer's illumination order.

(3) Chart operator's data.

(4) Computations and commands.

(5) Searchlight section chief's reports, to include orienting data, minimum elevations for each searchlight in its primary zone of responsibility, and time of refueling.

d. Computes Elevation for Direct Illumination. By using the data announced by the chart operator, the computer determines the difference in altitude (vertical interval), in meters, between the searchlight and the target. Using the computed vertical interval (to the nearest 10 meters) and the announced range (to the nearest 100 meters) to the target as arguments, the computer reads the elevation directly from a previously computed table. Table 9-1 is an example of such a table. If there is no table available, the computer can determine the elevation by using the military slide rule, as follows: divide the vertical interval (in meters) by the searchlight-target range (in thousands of meters). The answer, read to the nearest whole mil, is the elevation necessary to illuminate the target.

e. Computes Elevation for Diffused Illumination. When diffused illumination is used, the searchlight elevation must be sufficient to allow the beam to clear any masks between the searchlight and the target. By using the data announced by the chart operator, the computer determines the elevation to be used by adding the value, in mils, of one-half beam width to the minimum elevation for each searchlight.

f. Computes Elevation for Reflected Illumination. Using the data announced by the chart operator, the computer determines the elevation necessary to illuminate a target by reflection. Table 9-2 indicates the angle of elevation required to illuminate targets at fixed distances computed for certain cloud base heights. Figure 9-4 shows a means of obtaining cloud base height. Normally, the platoon commander will direct the assistant platoon commander or the searchlight section chief to measure and compute the cloud base height. This should be done prior to an indirect illumination mission. The clinometer on the M2 compass, or an aiming circle is used to measure the angle A shown in the figure. Angle A will be an approximation since irregularities in cloud formation will diffuse the beam over a considerable area. This diffusion will prevent the observer from perceiving the exact point at which the light beam

strikes the cloud coverage. However, the cloud base height computed by this method will be sufficiently accurate to illuminate an area prior to final adjustment.

g. Announces Commands. After the computer

has recorded the observer's initial illumination request and the light direction officer's illumination order and data, he announces the commands to the searchlights in the sequence given in the computer's record (fig 9-5).

Table 9-1. Elevations for Direct Illumination

Range (hundreds of meters)																														
Vertical Interval	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150
100	204	102	68	51	41	34	29	25	23	20	19	17	16	15	14	13	12	11	11	10	10	9	9	8	8	8	8	7	7	7
90	184	92	61	46	37	31	26	23	20	18	17	15	14	13	12	12	11	10	10	9	9	8	8	8	7	7	7	7	6	6
80	163	82	55	41	33	27	23	20	18	16	15	14	13	12	11	10	10	9	9	8	8	7	7	7	7	6	6	6	6	5
70	143	72	48	36	29	24	20	18	16	14	13	12	11	10	10	9	8	8	8	7	7	7	6	6	6	6	5	5	5	5
60	122	61	41	31	24	20	18	15	14	12	11	10	9	9	8	8	7	7	6	6	6	6	5	5	5	5	4	4	4	4
50	102	51	34	25	20	17	15	13	11	10	9	9	8	7	7	6	6	6	5	5	5	5	4	4	4	4	4	4	4	3
40	82	41	27	20	16	14	12	10	9	8	7	7	6	6	5	5	5	5	4	4	4	4	4	3	3	3	3	3	3	3
30	61	31	20	15	12	10	9	8	7	6	6	5	5	4	4	4	4	3	3	3	3	3	3	2	2	2	2	2	2	2
20	41	10	14	10	8	7	6	5	5	4	4	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	1	1	1
10	20	10	7	5	4	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Note. To compute elevation for vertical intervals (VI) greater than 100 meters, compute elevation in 100-meter VI increments, and then add as many 10-meter VI increments as necessary. Vertical interval and range factor are given in meters.

Table 9-2. Table of Angles of Elevation in Mils for Illumination by Reflection of Light Beams From Cloud Base

Height of cloud base above searchlight	Range from searchlight position to center of target area in thousands of meters														
Meters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
100	100	50	35	25	20	15	15	15	10	10	10	10	10	5	5
200	200	100	70	50	40	35	30	25	25	20	20	15	15	15	15
300	295	150	100	75	60	50	45	40	35	30	30	25	25	20	20
400	390	200	135	100	80	70	60	50	45	40	35	35	30	30	25
500	470	250	170	125	100	85	70	65	55	50	45	40	40	35	35
600	550	300	200	150	120	100	85	75	70	60	55	50	45	45	40
700	620	345	235	175	140	120	100	90	80	70	65	60	55	50	45
800	685	385	265	200	165	135	110	100	90	80	75	70	65	60	55
900	745	430	295	230	180	150	130	115	100	90	85	75	70	65	60
1000	800	470	325	250	200	170	145	125	110	100	90	85	80	70	70

Note

- The values indicated are to the nearest 5 mils.
- Cloud coverage of 60 percent or greater at reasonably uniform height over target area should exist.
- For conditions appearing below heavy line on table, better results probably will be obtained from illumination by diffusion rather than illumination by reflection.
- Cloud base height within 150-900 meters is desired.

Element
The searchlight(s) illuminating.

Beam spread

Control

Azimuth

Elevation

Source
LDO illumination order.

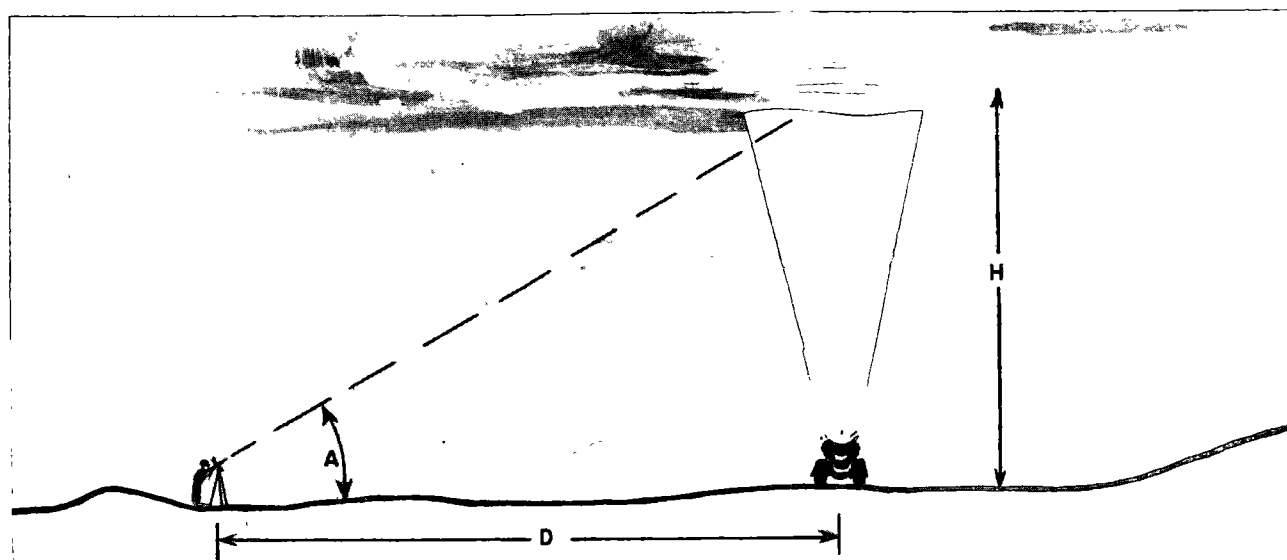
LDO illumination order

LDO illumination order

Announced by the chart operator.

Determined by the computer.

Example
MOON BEAM 3, ILLUMINATION
MISSION.
PENCIL.
WHEN READY.
DIRECTION 3000.
ELEVATION 30.



FOR A LESS THAN 300 MILS: $H = A \text{ (IN MILS)} \times D \text{ (IN THOUSANDS)}$

FOR A GREATER THAN 300 MILS: $H = D \text{ (IN THOUSANDS)} \times \tan A \text{ (IN MILS)}$

Figure 9-4. Method of determining height of cloud base.

Section IV. EXAMPLES OF ILLUMINATION MISSIONS

9-12. Example 1: Light Direction Center Procedure (fig 9-5)

a. General Information.

Unit: 30-inch searchlight platoon with six searchlights.

b. Procedure.

Observer's
request:

THIS IS NOBLE DELTA 44, ILLUMINATION MISSION, FROM REGISTRATION POINT, DIRECTION 4800, RIGHT 400, DOWN 10, DROP 600, SUSPECTED PATROL, ADJUST LIGHT.

LDO
announces:

NUMBER 3, DIRECT, PENCIL BEAM, WHEN READY, TARGET BX1008.

Chart operator
announces:

NUMBER 3, AZIMUTH 5180, RANGE 4000, ALTITUDE 335 METERS.

Commands by
computer:

MOON BEAM 3, LIGHT MISSION, PENCIL BEAM, WHEN READY, AZIMUTH 5180, ELEVATION MINUS 10.

Observer's corrections

LEFT 2 BEAMS, DOWN ½ BEAM.
HOLD
END OF MISSION, PATROL NEUTRALIZED.

Commands by computer

AZIMUTH 5120 ELEVATION MINUS 25.
HOLD.
CUT, END OF MISSION, PATROL
NEUTRALIZED.

9-13. Example 2: Light Direction Center Procedure

a. General Information. The general information for example 2 is the same as for example

1.

b. Procedure.

COMPUTER'S RECORD-SEARCHLIGHT (FM-6-115)						
ILLUMINATION MISSION <i>FROM RP, AZ 4800 R 400, D10, -600 SUSPECTED PATROL ADJUST LIGHT</i>			ALTITUDE OF SEARCHLIGHT <i>375</i>		ILLUMINATION MISSION <i>No. 3</i>	
			ALTITUDE OF TARGET <i>335</i>		SPREAD <i>PENCIL BEAM</i>	
			DIFFERENCE (<i>+</i>) <i>40</i>		CONTROL <i>WHEN READY</i>	
LDO ORDER <i>No. 3, DIRECT, PENCIL BEAM, WHEN READY TARGET BZ1001</i>			RANGE <i>4000</i>		AZIMUTH <i>5180</i>	
			ELEVATION (<i>+</i>) <i>10</i>		ELEVATION (<i>+</i>) <i>10</i>	
			TIME ILLUMINATION BEGUN <i>2205</i>		TIME ILLUMINATION COM- PLETED <i>2220</i>	
CORRECTIONS			SUBSEQUENT COMMANDS			
BEAM SPREAD	DEVIATION	ALTITUDE	BEAM SPREAD	CONTROL	AZIMUTH	ELEVATION
	<i>L2 BEAMS D½ BEAM</i>				<i>5120</i>	<i>-25</i>
	<i>HOLD</i>			<i>HOLD</i>		
<i>END OF</i>	<i>MISSION, PATROL</i>		<i>CUT, END OF</i>	<i>MISSION, PATROL</i>		
	<i>NEUTRALIZED</i>			<i>NEUTRALIZED</i>		
ADJUSTED DATA			<i>PENCIL BEAM</i>		<i>5120</i>	<i>-25</i>
REGARBONING DATA				DATE <i>20 AUG</i>		
MINUTES OPERATION REMAINING SINCE REGARBONING (CARRIED FOWARD) REFUELING			COMPUTER <i>L. GIL</i>			
MINUTES OPERATION THIS MISSION			SEARCHLIGHT <i>No. 3</i>			
NET MINUTES OPERATION REMAINING UNTIL REGARBONING REFUELING			CORG NUMBER TGT <i>BZ1001</i>			

DA FORM 1 JUN 56 6-38

Figure 9-5. Example of a completed computer's record.

Observer's request: THIS IS NOBLE DELTA 44, ILLUMINATION MISSION, GRID 246357
DIRECTION 4210, PATROL ACTIVITY IN AREA, INDIRECT, AD-
JUST LIGHT.

LDO announces: NUMBER 2, INDIRECT, PENCIL BEAM, WHEN READY, TARGET
BZ1008.

LDO to observer: NUMBER 2, INDIRECT, TARGET BZ1008.

Chart operator announces: NUMBER 2, AZIMUTH 3590, RANGE 5000, ALTITUDE 335 METERS.

Commands by computer: MOON BEAM 2, LIGHT MISSION, PENCIL BEAM, WHEN READY,
AZIMUTH 3590, ELEVATION PLUS 20.

<i>Observer's corrections</i>	<i>Commands by computer</i>
LEFT 100.....	AZIMUTH 3570, ELEVATION PLUS 20.
HOLD	HOLD.
END OF MISSION, PATROL NEUTRALIZED.	CUT, END OF MISSION, PATROL NEUTRALIZED.

CHAPTER 10

MAINTENANCE, DECONTAMINATION, AND DESTRUCTION OF EQUIPMENT:

INSPECTIONS: AND TRAINING

Section I. MAINTENANCE

10-1. General

Maintenance is essential to insure that the section is prepared to carry out its mission immediately. Systematic maintenance provides the best insurance against unexpected breakdown at the critical moment when maximum performance is essential.

10-2. Disassembly, Adjustment, and Assembly

Authorized disassemblies and adjustments of the searchlight and engine generator authorized to be performed by battery personnel are

prescribed in technical manuals pertaining to the equipment. Deviation from these prescribed procedures is not allowed, except as authorized by the responsible maintenance offices.

10-3. Maintenance

Detailed instructions for maintaining the 23-inch or 30-inch searchlight and engine generator and the ¼- and ¾-ton (or 1¼-ton) trucks are contained in the appropriate technical manuals and lubrication orders. Equipment records will be maintained in accordance with TM 38-750.

Section II. DECONTAMINATION OF EQUIPMENT

10-4. General

Equipment that has been contaminated by chemical or biological agents or radioactive material constitutes a danger to personnel. Decontamination is accomplished by removing, neutralizing, destroying, or covering toxic agents or radioactive material (TM 3-220). In most cases, decontamination only reduces the hazard from CBR contamination to an acceptable level. Periodic checks must be made to insure that the hazard does not return. The first priority of decontamination is personnel. Those pieces of equipment and the areas that are needed for the accomplishment of the mission must then be decontaminated.

10-5. Decontamination Principles

a. In all decontamination operations, the soldier must exercise care to avoid contaminating himself. After clothing or equipment has been decontaminated, the adequacy of the decontamination should be tested to avoid later hazard. Equipment which has been contaminated with a chemical agent should be periodically rechecked for adequacy of decontamination; such equipment should be marked as having been contaminated. When heated, equipment contaminated with chemical agents may produce a vapor hazard.

b. For detailed information on decontamination, see FM 21-40 and TM 3-220.

Section III. DESTRUCTION OF EQUIPMENT

10-6. General

a. The destruction of the searchlight and associated equipment subject to capture or abandonment in the combat zone will be undertaken by the using unit only when, in the judgment of the unit commander concerned, such action is necessary in accordance with the order of, or the policy established by, the Army commander.

b. The information given in paragraph 10-7 is for guidance only. Some of the procedures require the use of explosives and incendiary grenades which may not be authorized items of issue for the using unit. The issue of these items and related materials and the conditions under which destruction will be accomplished must be a matter of command decision, based on the tactical situation in each case.

10-7. Methods of Destruction

a. All personnel of the unit must know the plan and priority of destruction of equipment. The methods of destruction are as follows:

(1) To destroy the searchlight, use an ax or sledge to completely smash and destroy all electrical equipment, the control box, azimuth and elevation controls and scales, cables and cable receptacles, and hydraulic equipment. Break the glass and throw a hand grenade into the drum. If grenades or other explosives are not available, use an ax or sledge or a concentrated burst of machinegun fire to gain the same effect. Make certain that the mirror is thoroughly distorted and perforated and that the burner plate assembly is completely destroyed.

(2) To destroy the engine-generator, use an ax or sledge to completely smash and destroy the control panel, sparkplugs, distributor, and electrical cables. Place an incendiary grenade on the engine block. Unlatch the commutator

cover from the generator and drop an incendiary grenade into the aperture.

b. When equipment must be destroyed to prevent its use by the enemy, the searchlight and associated equipment must be so damaged that they cannot be restored to a usable condition in the combat zone by either repair or cannibalization. However, when lack of time and personnel prevents destruction of components, priority will be given to the destruction of those components most difficult to replace. It is equally important that the same essential parts on all equipment must be destroyed so that the enemy cannot salvage a complete searchlight or engine-generator from undamaged parts.

c. When destruction of equipment is directed, consideration should be given to—

(1) Destruction in such a manner as to cause the greatest obstruction to enemy movement and to prevent hazard to friendly troops from fragments when explosives are used.

(2) Appropriate safety precautions.

Section IV. INSPECTIONS

10-8. Inspections

Regular inspections are required to insure that materiel is maintained in serviceable condition.

a. The chief of section is responsible for the equipment within the section. He should inspect the equipment thoroughly each day and take immediate action to correct any deficiencies found.

b. The platoon commander, accompanied by the searchlight electrician, should make a daily spot check inspection of different parts of the materiel each day to insure complete coverage every few days. He should also make frequent mechanical inspections of the searchlight, engine-generator, truck, auxiliary equipment, tools, and spare parts.

c. Battery and higher commanders should make frequent command inspections to insure that the equipment in their commands is being maintained at prescribed standards of appearance, condition, and completeness.

d. Duties of individuals in performing the necessary maintenance of the searchlight, power generator, and trucks are outlined in paragraphs 10-9 through 10-12. Work will be routine, thorough, and rapid if the procedures outlined in these paragraphs are followed. When the section is reduced in strength, the chief of section must reassign duties to insure that all maintenance is completed.

e. For details on inspecting the 30-inch searchlight, power generator, trucks, and associated section equipment, see appropriate technical manuals.

10-9. Duties in Inspection Before Operation (March)

The inspection performed before operation is a final check on materiel before departure for training in the field, before leaving the bivouac area for combat, or before displacement. After inspection and after all deficiencies have been corrected, the trucks, searchlight, power generator, and auxiliary equipment are ready to go into action. Individual duties of personnel are listed in table 10-1.

10-10. Duties in Inspection During Operation (March)

The inspections performed during operation are constant checks on the functioning of the trucks and the security of all stowed equipment. The responsibilities and duties of section personnel are as follows:

a. The chief of section supervises march discipline. He assists the driver of the lead vehicle in detecting obstacles that could cause injury to personnel or damage to the trucks. He also periodically inspects the security of the pintle on the ¼-ton truck and the lunette and safety

chains on the searchlight trailer.

b. One of the searchlight operators operates the $\frac{1}{4}$ -ton truck prime mover for the searchlight and inspects all instruments and controls. The other crewman assists the power generator operator by performing the duties of an assistant driver for the $\frac{3}{4}$ -ton (or $1\frac{1}{4}$ -ton) truck prime mover.

c. The power generator operator operates the $\frac{3}{4}$ -ton (or $1\frac{1}{4}$ -ton) truck and inspects all instruments and controls.

10-11. Duties in Inspection During Halt

Inspections are made at the halt to insure that the trucks, searchlight, engine-generator, and associated equipment are in satisfactory oper-

ating condition. The halt provides the section an opportunity to inspect for malfunctions that could not be detected during operation. The inspection duties of the members are listed in table 10-1.

10-12. Duties in Maintenance After Operation

Immediately after operation, the trucks, searchlight, and power generator are given whatever maintenance is needed to prepare them for further sustained action or to determine the need for additional maintenance by higher echelons. These operations may be performed in a training area, a bivouac area, or a combat position. Individual duties of searchlight section personnel are listed in table 10-1.

Section V. TRAINING

10-13. Section Drill

Duties of the chief of section and section personnel in service of the searchlight are contained in appendix B.

10-14. Duties in Action

Duties of the chief of section and searchlight

crewmembers in action are contained in appendix C.

10-15. Training Administration

The requirements for the training of searchlight battery personnel are contained in ATP 6-558, and in appendix D.

Table 10-1. Inspection Duties—30-Inch Xenon Searchlight

Sequence	Chief of section	Number 1 searchlight crewman	Number 2 searchlight crewman	Number 3 power generator operator
BEFORE OPERATION (MARCH) (B) AND DURING THE HALT (D)				
1	Supervises inspection and duties of crewmen in all sequences. Commands MARCH ORDER, and guides generator prime mover to hookup position.	(B) After coolant pump and exhaust blower have stopped, directs generator operator to shut off generator.	(B) Positions generator prime mover as directed by Chief of Section.	(B) Turns off generator. Disconnects power cable from generator and searchlights. Winds cable on cable reel and stores cable reel and cable on generator prime mover.
2	Assists No. 3 to connect generator to prime mover.	(B) Disconnects the control-indicator cable and stores the cable in the spare parts kit box. Places protective caps over the electrical receptacles.		(B) Connects the generator to the prime mover. Connects intervehicular cable and safety chains.

Table 10-1. Inspection Duties—30-Inch Xenon Searchlight—Continued

Sequence	Chief of section	Number 1 searchlight crewman	Number 2 searchlight crewman	Number 3 power generator operator
3	(B) Verifies presence of technical manuals and lubrication orders for searchlight, power generator, and vehicles; trip ticket; driver's license; and accident report forms.	(B) Assists No. 2.	(B) Elevates the lamp drum assembly to vertical positions and attaches elevation transport shock springs.	(D) Checks water, fuel, and oil levels. (Checks ether supply during cold weather.)
4		(B) Rotates the trunnion assembly to searchlight rear and checks the red steps visible on left and right azimuth stop assemblies.	(B) Assists No. 1.	(B) Secures ground rod.
5		(B) Checks coolant level and supply.	(B) Attaches azimuth transport shock spring to trunnion assembly.	(B) (D) Performs inspection duties on power generator as prescribed by the appropriate technical manual.
6	Positions searchlight prime mover.	(B) Replaces canvas cover over searchlight. Attaches lunette to prime mover pintle.	(B) Assists No. 1.	Assists No. 1.
7	(B) (D) Verifies that the searchlight is properly secured in traveling position.	(B) Raises parking stand to lock position and swivels parking stand to stored position.		(B) (D) Checks prime mover coolant, fuel and oil levels.
8		(B) Attaches intervehicular cable, releases hand brakes, and disengages hand wheel detents.	(B) Connects safety chains.	(B) Checks emergency destruction materials for searchlight section.
9	Verifies searchlight and generator are prepared for march and reports to platoon commander, "Sir, No. (so-and-so) in order", or reports any defects the section cannot remedy without delay.	Reports "Number 1 ready."	Reports "Number 2 ready." (B) (D) Performs inspection duties on vehicle as prescribed by the appropriate technical manual.	Reports "Number 3 ready."

Table 10-1. Inspection Duties—30-Inch Xenon Searchlight—Continued

Sequence	Chief of section	Number 1 searchlight crewman	Number 2 searchlight crewman	Number 3 power generator operator
AFTER OPERATION				
1	Supervises inspection by all members of the searchlight section in all sequences.	Cleans outside surface of searchlight to include filter and air vents.	Cleans drum interior.	Performs inspection duties on vehicles as prescribed by the appropriate technical manual.
2		Examines all exposed insulations for evidence of oil, grease, dirt, and moisture. Cleans if necessary.	Cleans and examines mirror.	
3		Examines machined parts and castings for evidence of rust. Cleans if necessary.	Examines, cleans, and lubricates lamp, as prescribed by the appropriate technical manual.	Performs inspection duties on power generator as prescribed by the appropriate technical manual.
4		Examines level handwheels for evidence of dirt. Cleans if necessary. Checks elevation and azimuth brakes.	Cleans searchlight lens.	Checks for evidence of parts loosened by vibration or fuel leaks. Refuels as necessary.
5		Cleans and lubricates remainder of searchlight as directed by chief of section.		
6	Reports to platoon commander, "Sir, Number (so-and-so) in order", or reports any defects which the section cannot remedy without delay.	Reports, "Searchlight ready," or reports any defects or malfunctions found.	Stores cleaning and preserving materials. Performs inspection duties on vehicles as prescribed by the appropriate technical manual.	Reports, "Power generator ready," or reports any defects or malfunctions found.



APPENDIX A

REFERENCES

A-1. Army Regulations (AR).

220-58	Organization and Training for Chemical, Biological, and Radiological Operations.
310-25	Dictionary of United States Army Terms (Short Title: AD).
310-50	Authorized Abbreviations and Brevity Codes.
385-10	Army Safety Program.
611-201	Manual of Enlisted Military Occupational Specialties.
750-5	Organization, Policies, and Responsibilities for Maintenance Operation.

A-2. Department of the Army Pamphlets (DA Pam).

310-series	Military Publications (as applicable).
350-15-series	Operations—Lessons Learned.

A-3. Army Training Program (ATP).

6-558	Field Artillery Searchlight Battery.
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A-4. Table of Organization and Equipment (TOE).

6-558	Field Artillery Battery, Searchlight.
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A-5. Field Manuals (FM).

5-15	Field Fortifications.
5-20	Camouflage.
5-25	Explosives and Demolitions.
6-2	Field Artillery Survey.
6-10	Field Artillery Communications.
6-20-1	Field Artillery Tactics.
6-20-2	Field Artillery Techniques.
6-40	Field Artillery Cannon Gunnery.
6-121	Field Artillery Target Acquisition.
6-140	Field Artillery Cannon Battalions and Batteries.
19-50	Military Police in Stability Operations.
20-60	Battlefield Illumination.
21-5	Military Training Management.
21-6	Techniques of Military Instruction.
21-30	Military Symbols.
21-40	Chemical, Biological, Radiological and Nuclear Defense.
21-41	Soldier's Handbook for Defense Against Chemical and Biological Operations and Nuclear Warfare.
21-48	Chemical, Biological and Radiological (CBR) and Nuclear Defense Training Exercises.

21-60	Visual Signals.
22-5	Drill and Ceremonies.
24-1	Tactical Communications Doctrine.
24-18	Field Radio Techniques.
24-20	Field Wire and Field Cable Techniques.
31-16	Counter guerrilla Operations.
31-21	Special Forces Operations, US Army Doctrine.
31-22	US Army Counterinsurgency Forces.
31-23	Stability Operations—US Army Doctrine.
31-36 (Test)	Night Operations.
(C)31-40	Tactical Cover and Deception (U).
31-73	Advisor Book for Stability Operations.
(C)32-5	Signal Security (SIGSEC) (U).
(C)32-20	Electronic Warfare (Ground Based) (U).
33-1	Psychological Operations—US Army Doctrine.
41-10	Civil Affairs Operations.
61-24	Division Communications.
61-100	The Division.
100-5	Operations of Army Forces in the Field.
(C)100-20	Field Service Regulations. Internal Defense and Development (IDAD) (U).
101-10-1	SOFM, Organizational, Technical and Logistical Data—Unclassified Data.

A-6. Technical Manuals (TM).

3-220	Chemical, Biological, and Radiological (CBR) Decontamination.
6-300-()	Army Ephemeris (as applicable).
9-1300-200	Ammunition, General.
21-300	Driver Selection and Training (Wheeled Vehicles).
21-305	Manual for the Wheeled Vehicle Driver.
38-750	The Army Maintenance Management System (TAMMS).

APPENDIX B

SECTION DRILL

Section I. GENERAL

B-1. Objective

The objective of section drill is attainment of efficiency—maximum precision coupled with high speed.

B-2. Instructions

a. Adherence to drills prescribed in this section is necessary to develop maximum efficiency and prevent injuries to personnel and damage to equipment. Section drill should be conducted in silence except for commands and reports.

The section must be drilled until reactions to commands are automatic, rapid, and efficient. Mistakes are corrected immediately.

b. Duties should be rotated during training so that each member of the section can perform all the duties within the section. In addition, battery personnel not assigned specific duties during drill periods should be trained in the fundamentals of section drill so that they will be capable of functioning efficiently with a searchlight section, if required.

Section II. PRELIMINARY COMMANDS AND FORMATIONS

B-3. To Form the Section

a. *To Fall In.* The chief of section takes his post. On the command of execution, the section forms in a single rank centered on and facing the chief of section at a distance of 3 paces. The chief of section may indicate in his preparatory command the place and direction in which the section is to form. The command is FALL IN or IN REAR OF THE LIGHT, FALL IN. Execution is as follows: The section moves at double time and forms at normal interval, at attention, with Number 1 on the right, Number 2 in the middle, and Number 3 on the left. The section guides on Number 1.

b. *To Call Off.* The section being in formation, the command is CALL OFF. At the command, all personnel in ranks, except Number 1, execute eyes right. The section then calls off in sequence, 1, 2, 3. As each man calls out his designation, he turns his head smartly to the front.

B-4. To Post the Section

The command is SECTION, POSTS. The command is general and is applicable whether the section is in or out of ranks, at a halt, or marching. All movements are executed at dou-

ble time and are terminated at a position of attention.

B-5. To Change Posts

Posts of the section personnel should be changed frequently so that all members of the section will be trained in all duties. The section being *in formation*, the command to change posts is CHANGE POSTS, MARCH. At the command MARCH, Number 3 moves at double time in rear of the section to the post of Number 1 and all other numbered crewmen take two left steps.

B-6. To Fall Out

a. *During Drill.* When it is desired to give the personnel a rest from drill or to relieve them temporarily from a formation or post, the command FALL OUT is given. The command may be given at any time, and it means that the section is to remain in the vicinity of the drill area.

b. *When Searchlight is in Action.* When action has been suspended temporarily, but it is desired to have the section remain in the vicinity of the searchlight, the command FALL OUT

is given. Men stand clear of the searchlight to insure that settings and laying remain undisturbed. During these periods, the chief of section may direct the men to improve the position or do other necessary work.

B-7. General

The searchlights of a battery will be emplaced individually under the direction of the chiefs of sections. Preparation of the position prior to occupation is governed by the time available and the unit SOP. To facilitate the occupation, a stake should be driven into the ground at a point where the center of each searchlight is to be placed.

B-8. To Prepare for Action

a. The searchlight being in position or approaching the position, the command to prepare it for action is **PREPARE FOR ACTION**. Duties of individuals are given in table B-1. Each man takes his post upon completion of his duties.

b. If **PREPARE FOR ACTION** has not been ordered before the searchlight is established

in position, the command is habitually given by the chief of section as soon as the section vehicles are halted in position. If the searchlight is not to be prepared for action, a supplementary command, "Do not prepare for action" must be given.

B-9. March Order

a. *Conventional Movement.* To prepare to resume travel, the command is **MARCH ORDER**. Duties of individuals are given in table B-2. Each man takes his post upon completion of his duties.

b. *Air Movement.* Duties of individuals remain as given in table B-2; however, the following precautions must be taken prior to air movement:

- (1) All loose equipment must be secured.
- (2) Gas tank and gas cans will be only three-quarters full.
- (3) Radio antennas are removed.
- (4) The 30-inch searchlight or generator should not be sling loaded, as damage to equipment may result.

Table B-1 Duties in Prepare for Action

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (power generator operator)
1.	Commands, "Prepare For Action," Guides the light over the position stake, facing the lunette toward the area to be illuminated. Guides generator to selected position.	Dismounts, and disconnects the safety chain.	Sets vehicle parking brake and dismounts. Sets the searchlight parking brake and disconnects intervehicular cable.	Drives the generator to position selected by chief of section and sets vehicle parking brake. Dismounts and removes canvas covers.
2.	Supervises all members of section through all sequences while assisting Number 3.	Swivels the forward leveling support into position, locking in place, adjusts, and roughly levels the trailer from front to back. <i>Note.</i> Both pins must be securely emplaced or support stand will collapse.		Disconnects the generator from the prime mover.
3.	Assists Number 1 and Number 3.	Opens pintle on towing vehicle and removes	Assists Number 1 and removes towing vehi-	Removes the cable reel with power cable,

Table B-1. Duties in Prepare for Action—Continued

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (power generator operator)
		the vehicle from the searchlight. Caution: Do not lift lunette too high or searchlight will tip backwards.	cle from the searchlight.	from the vehicle and unreels the cable from the generator to the searchlight. (Do not connect cable.)
4.		Removes the canvas cover from the searchlight.	Assists Number 1.	Performs a Before Operation Check on the generator.
5		Hangs control indicator on clip on right trunnion arm and connects the control indicator cable between the control indicator receptacle and receptacle on searchlight. Warning: Be sure generator set is not operating when making cable connections.	Depresses plunger on elevation shock spring pin, removes pin, then removes shock spring from lamp drum, and reconnects to stowage post on trunnion assembly. Removes pin from Azimuth transport shock spring and disconnects it.	Connects the power cable to receptacle on searchlight and generator.
6.		Rotates searchlight in azimuth so that front door faces the direction of the desired area to be illuminated.	Assists Number 1.	
7.		Places the start-on-off switch, on the control indicator, to the off position.		
8.		Directs the generator operator to start the generator.	Raises the base level door, opens the valve on the azimuth fording seal hand pump by turning it counterclockwise one half turn to release the azimuth brake.	Starts the generator as directed, checks the operational controls and adjusts the output voltage to 208 VAC.
9.		Opens the valve on the elevation brake hydraulic hand pump by turning it counterclockwise one-half turn to release the elevation level.	Rotates the trunnion assembly until base level is in line with the forward leveling support and the rear of the searchlight.	

Table B-1. Duties in Prepare for Action—Continued

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (power generator operator)
10.		Turns on the indicator light switches (If in night occupation).	Pulls back on hand-wheel detents and rotates them until they clear the grooves in the frame.	
11.		Positions the lamp drum assembly to a zero mil setting on the elevation scale indicator.	Using the leveling handwheels, raises or lowers the rear of the trailer until the front rear bubble in the base level is centered. (Turning clockwise raises; turning counter-clockwise lowers)	
12.		Opens the door of drum level and checks drum level. If bubble is centered, the elevation scales are correctly centered. If bubble is not centered, move the lamp drum assembly until the bubble is centered.	Raises or lowers either side of the trailer by use of the leveling handwheels until the side to side bubble of the base level is centered.	
13.		Locks the elevation brake hydraulic hand pump by turning the valve clockwise, and pumping the hand lever.	Rotates handwheel detents to lock position.	
14.		Loosens the two screws that secure the elevation scale and moves the elevation scale until the zero mil indication is in the center of the elevation scale indicator. Tightens the two screws.		
15.		Lays the searchlight for direction.	Assists Number 1.	
16.	Confirms the lay of the searchlight then, reports to the Platoon Leader, "Sir, Number—in order."			

Table B-2. Duties in March Order

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (power generator operator)
1.	Commands, "MARCH ORDER", and supervises all members of section through all sequences.	Directs the generator operator to shut off the generator (after the coolant pump and exhaust blower have stopped).		Shuts off the generator as directed and disconnects the power cable from the generator set and the receptacle on the searchlight, and winds the cable on the cable reel.
2.	Assists Number 3.	Disconnects the control-indicator cable from the searchlight and stows the control-indicator and cable in the spare parts kit box.		Stows the cable reel and power cable on the generator prime mover, and connects the generator to its prime mover.
3.		Places the protective caps over the electrical receptacles, and assists Number 2.	Elevates the lamp drum assembly to a vertical position and attaches the elevation transport shock springs.	Replaces canvas cover on generator.
4.		Rotates the trunnion assembly so that the transformer case is at the rear of the searchlight. Checks to see that the red steps are visible on the left and right azimuth stop assemblies.	Assists Number 1.	
5.		Replaces canvas cover over the searchlight.	Attaches the azimuth transport springs to the trunnion assembly, and assists Number 1.	
6.	Assists Numbers 1 and 2.	Assists Number 2.	Positions the prime mover so that the lunette towing attachment can be engaged with the pintle on the towing vehicle, and put the lunette in the pintle. <i>Caution:</i> Do not lift lunette to high or searchlight will tip backwards.	

Table B-2. Duties in March Order—Continued

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (power generator operator)
7.		Raises the parking stand to its stowed position and lock in place with level lock pin. Removes the parking stand pin and swivels the parking stand to its stowed position, and locks in place with the parking stand lock pin.	Assists Number 1.	
8.		Attaches the intervehicular cable, connects the safety chain to the vehicle, and releases the searchlight hand brake.	Disengages handwheel detents, and rotates the rear leveling handwheels until the torsion bars in relation to the indicator are at a setting of 45 degrees.	
9.	Verifies that the searchlight is prepared for traveling and reports to the platoon leader, "Sir, Number — in order," or reports any defects the section cannot remedy without delay.			

APPENDIX C

DUTIES IN ACTION

C-1. Duties of Individuals

The general instructions given in paragraph B-2 on section drill apply equally to section drill in duties in action. In general, the duties of individuals in the section in action are as follows:

a. The chief of section supervises and commands the section and is responsible for insuring that all duties of the section are performed properly, that all commands are executed, and that all safety precautions are observed.

b. The searchlight crewmen (Numbers 1 and 2) operate the searchlight and lay the searchlight for direction and elevation. One of the crewmen also drives and maintains the ¼-ton truck which tows the searchlight.

c. The power generator operator operates and maintains the power generator and drives and maintains the ¾-ton (or 1¼-ton) truck which tows the generator.

C-2. Chief of Section

a. *Duties.* The chief of section—

- (1) Follows illumination commands.
- (2) Supervises the positioning of the searchlight and generator.
- (3) Measures the site to the mask when the mission is to provide indirect illumination.
- (4) Reports mistakes and unusual incidents to the platoon commander.
- (5) Conducts prearranged illumination.
- (6) Records basic data.
- (7) Observes and checks the functioning of the searchlight and generator.

(8) Assigns duties when operating with reduced personnel.

(9) Controls the movement of the searchlight prime movers.

b. *Detailed Description of Duties.*

(1) *Follows illumination commands.* The chief of section will follow illumination commands. He repeats the commands as required to the searchlight crewmen.

(2) *Supervises the positioning of the searchlight and generator.* The chief of section closely observes the positioning of the searchlight and generator, making certain that the searchlight

is positioned so as to accomplish the illumination commands.

(3) *Measures the site to the mask when the mission is to provide indirect illumination.* On the command MEASURE THE SITE TO THE MASK, the chief of section directs one of the searchlight crewmen to traverse while the other crewman elevates the searchlight until it is sighted at the highest point on the mask. The chief of section then verifies the laying and reads on the elevation scale the angle of site to the mask and reports to the light direction center, "Number (so-and-so), site (so much)."

(4) *Reports mistakes and unusual incidents to the platoon commander.* If the searchlight cannot be placed into action, the chief of section promptly reports that fact and the reasons therefor to the platoon commander; for example, "Sir, Number (so-and-so) out of action, on-off switch not functioning." When it is discovered that the searchlight is illuminating with a mistake in laying, the chief of section reports that fact at once; for example, "Sir, Number (so-and-so) illuminated 100 mils right." Likewise, he promptly reports other unusual incidents that affect the service of the searchlight.

(5) *Conducts prearranged illumination.* Whenever the execution of prearranged illumination is ordered, the chief of section conducts the illumination mission in conformity with the prescribed data.

(6) *Records basic data.* The chief of section records data of a semipermanent nature, such as minimum elevations to masks, aiming points used and their azimuths, prearranged illumination, and limits of the zone of action.

(7) *Observes and checks the functioning of the searchlight and generator.* The chief of section closely observes the functioning of the searchlight and generator during action. He promptly reports any evidence of malfunctioning to the light direction center.

(8) *Assigns duties when operating with reduced personnel.* Whenever the number of personnel servicing the searchlight is temporarily reduced below that indicated herein, the chief of section reassigns duties to best facilitate the service of the searchlight.

(9) *Controls the movement of the searchlight prime movers.* When it is necessary to move the searchlight and generator prime movers, the chief of section instructs the drivers as to the disposition of the vehicles. He then con-

trols the displacement and assists the drivers through the use of hand and arm signals.

C-3. Searchlight Crewmen

Individual duties in action of the searchlight crewmen are listed in table C-1.

Table C-1. Duties of Searchlight Crewmen in Action

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (generator operator)
1	Reports to the light direction center "Ready for action," and repeats all commands received from the light direction center.	Positions the searchlight in elevation, matching the elevation pointer with the announced reading on the elevation scale.	Positions the searchlight in azimuth, matching the azimuth pointer with the announced reading on the azimuth scale.	Starts generator on direction of the chief of section. Adjusts output voltage to read 208 volts.
2		Activates the Xenon bulb by placing the start-on-off switch in start position when directed to do so by the chief of section.	Follows subsequent commands.	
3		Verifies that the voltmeter reads 38 volts and the ammeter reads 395* amperes; if adjustment is required he directs the generator operator to adjust the voltage.		Adjusts voltage as directed by Number 1.
4	Repeats subsequent commands received from the light direction center.	Follows subsequent commands.	Repeats sequence 1 above. Adjusts the beam spread on command from the chief of section by adjusting the beam spread control knob. Spread beam can also be accomplished by replacing the infrared lens on the front doors with the spread beam lens.	Observes generator operation and instrument readiness and makes adjustments as necessary.
5	Repeats command "Cut" received from the light direction center.	Places the start-on-off switch in the off position.		

*Pertains to a 15KW generator.

C-4. Employment of Infrared Filters

Normal employment of the 30-inch Xenon searchlight will be with infrared filters mounted on the hinged front door of the lamp drum. An infrared filter holder containing the hinged infrared filter segments and infrared fil-

ter clamps keeps the lens in the closed position during infrared operation. During visible light operation, the infrared filter is open. Spread beam will be accomplished by defocusing using the beam spread control knob.

APPENDIX D

TRAINING

Section I. GENERAL

D-1. Purpose and Scope

The purpose of this appendix is to present the absolute minimum requirements for training the personnel of a searchlight battery in the subjects contained in this manual. It includes general information on the conduct of training and a minimum training schedule.

D-2. Objectives

The objectives of training are to speed the attainment of proficiency by searchlight battery personnel in their individual duties and, through drill, the welding of the section into an effective coordinated unit capable of functioning effectively in combat. During training, supervisors should keep in mind the proficiency sought by ATT 6-558 for the field artillery searchlight battery.

D-3. Conduct of Training

a. Training will be conducted in accordance with the principles set forth in FM 21-5. The goal of training will be the attainment of the standards set forth in AR 611-201.

b. In general, individual training is conducted by noncommissioned officers as far as practicable. Officers are responsible for preparing training schedules for conducting unit training, and for supervising and testing individual training.

c. Throughout training, the application of prior instruction to current training must be emphasized.

d. A record of the training received by each individual should be kept on a progress card by each chief of section for each man in his section. This card should show each period of instruction attended, tests taken, and remarks pertaining to progress. Progress cards should be inspected frequently by the platoon and battery com-

manders to insure that they are being kept properly and to determine the state of training. *Requiring the chief of section to keep these records emphasizes his responsibility toward his section.*

e. The necessity for developing leadership and initiative in non-commissioned officers must be emphasized constantly throughout training.

f. The training of individuals in technical specialties should be arranged for outside of the time allotted in these schedules.

g. Administrative, supply, and maintenance personnel will receive on-the-job training in these functions under the supervision of key non-commissioned officers.

h. Subjects involving similar time-consuming preparations may be combined where practicable. For example, a reconnaissance, selection, and occupation of position may be preceded by a road march.

D-4. Phases

a. The training program is divided into the *section phase* and the *battery phase*.

b. For the purpose of this appendix, the term "section" as applied to the searchlight battery denotes an element of the battery which has specific functions found only in that type of section; for example, battery headquarters, communication section, platoon headquarters, or searchlight section.

c. The training for the searchlight sections has been combined, since training of the individual sections can be handled best under the immediate supervision of the platoon commanders.

d. Two or more sections of the battery may be combined during the *section phase* to receive training in subjects which are common to the sections.

Section II. MINIMUM TRAINING SCHEDULE

D-5. General

The training schedule given in paragraphs D-6 through D-11 is a guide for meeting the minimum training requirements of personnel of a searchlight battery in subjects covered in this manual. Applicable technical manuals provide

information on which to base periods of instruction on description, characteristics, and functioning of the searchlight, vehicles, and power generators. *Additional training beyond the scope of this schedule is necessary to develop an efficient and well-trained section.*

D-6. Battery Headquarters (Section Phase)

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text references	Training aids and equipment
C	1	Duties of individuals		Blackboard.
C	1	Command post installations.	Para 3-4—3-6	Blackboard.
C	1	Reconnaissance, selection, and occupation of position.	Para 3-1—3-3 and 3-10—3-12.	Blackboard and sandtable.
C	1	Organization of position.	Para 4-1, 4-4a and 4-5.	
D, PW	8	Field exercise in reconnaissance, selection, occupation, and organization of position.	Review previous reference.	TOE equipment.

D-7. Communication Personnel (Wire and Radio)

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text reference	Training aids and equipment
C	1	Duties of individuals.		Blackboard.
C	3	Battery wire systems.	Para 5-1—5-7.	Blackboard.
C	2	Battery radio system.	Para 5-1, and 5-8—5-11.	Blackboard.
D, PW	12 (4-hour periods)	Field exercise in the installation of a battery wire and radio system.	Review previous references.	TOE equipment.

D-8. Platoon Headquarters (Section Phase)

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text reference	Training aids and equipment
C	1	Duties of individuals.		Blackboard.
C	1	Command post installations.	Para 3-4—3-6.	Blackboard.
C	1	Reconnaissance, selection and occupation of position.	Para 3-1—3-3 and 3-10—3-12.	Blackboard and sandtable.
C	1	Organization of position.	Para 4-1, 4-4a and 4-5.	Blackboard.
D, PW	8 (4-hour periods)	Field exercise in reconnaissance, selection, occupation and organization of position.	Review previous references.	TOE equipment.

D-9. Light Direction Center Personnel (Section Phase)

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text reference	Training aids and equipment
C	1	Principles of light direction center operation.	Para 9-1—9-7.	Blackboard.
D, PW	3	Duties of individuals.	Para 9-8—9-11.	Blackboard and TOE equipment.
C, PW	2	Light direction center procedure.	Para 9-12 and 9-13.	Blackboard and TOE equipment.
D, PW	8 (4-hour periods)	Field exercise in operation of a light direction center.	Review previous references.	TOE equipment.

D-10. Searchlight Sections (Section Phase)

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text reference	Training aids and equipment
C	1	Organization of position and section.	Para 4-1 and 4-4—4-6.	Blackboard and sandtable.
C	1	Duties of individuals in section.	App B	Blackboard.
C, D, PW	4	Section drill.	App B.	Blackboard and TOE equipment.
C, D, PW	4	Duties in action	App C	Blackboard and TOE equipment.
C, D, PW	2	Maintenance and inspections.	Para 10-1—10-3 and 10-9—10-12.	Blackboard and TOE equipment.
C	1	Decontamination and destruction of equipment.	Para 10-4—10-7, and FM 21-40, TM 3-220.	Blackboard.
D, PW	8 (4-hour periods)	Field exercise in operation of a searchlight section.	Review previous references.	TOE equipment.

D-11. Battery (Battery Phase)

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text reference	Training aids and equipment
C	1	Organization and mission of the searchlight battery.	Para 2-1—2-8	Blackboard.
C	2	Capabilities and limitations of battlefield illumination and special operations.	Para 6-1—6-19.	Blackboard.
C, PW	3	Illumination planning and adjustment of illumination.	Para 7-1—7-7.	Blackboard.
C	2	Reconnaissance, selection, and occupation of position.	Para 3-1—3-14.	Blackboard.

Method	Hours	Subject	Text reference	Training aids and equipment
C	1	Organization of position.	Para 4-1—4-6.	Blackboard.
C	1	Communication.	Para 5-1—5-11.	Blackboard.
D, PW	4	Field exercise in reconnaissance, selection and occupation of position.	All previous references.	TOE equipment.
D, PW	8	Field exercise in reconnaissance, selection and occupation of position.	All previous references.	TOE equipment.
D, PW	8	Field exercise in reconnaissance, selection and occupation of position.	All previous references.	TOE equipment.

APPENDIX E

STANDARDIZATION AGREEMENT (STANAG NO. 2088)

E-1. GENERAL

Standardization Agreements (STANAGS) are international (NATO) agreements designed to facilitate inter-Allied operations. Upon ratification by the United States, a STANAG is binding upon US Army Forces (entirely or with exceptions as noted). This appendix provides information of the STANAG implemented by this manual; it also lists other STANAG's which are not implemented by this manual but are of general interest to the users of this manual.

E-2. EXTRACT OF STANAG No. 2088. Battlefield Illumination

Following is an EXTRACT of STANAG No. 2088 which provides information of particular interest and guidance for the Searchlight Battery.

NATO UNCLASSIFIED DETAILS OF AGREEMENT

GENERAL

1. This STANAG deals with the illumination of the battlefield by visible light and does not deal specifically with the use of infra-red or other invisible rays.

AGREEMENT

2. It is agreed that the NATO Armed Forces operating on land are to:

- a. subscribe to the requirements, principles and definitions defined in paragraphs 3, 4 and 5 (below);
- b. employ the techniques, pattern of illumination and methods of requesting and adjusting prescribed in paragraph 6 (below);
- c. employ the procedures for preparing the Illumination Plan prescribed in paragraphs 7 and 8 (below).

GENERAL REQUIREMENTS FOR ILLUMINATION

3. The principal requirement for battlefield illumination is to overcome the limitations imposed on friendly forces by the absence of lights. The requirements for battlefield illumination originate with those of an individual, a patrol, or a squad and may progress in increasing magnitude to the requirements for units and formations.

PRINCIPLES OF BATTLEFIELD ILLUMINATION

4. The following principles govern the use of battlefield illumination:
- a. The use of battlefield illumination is a command responsibility.
 - b. Battlefield illumination in support of friendly forces should be provided wherever and whenever needed, in the intensity of illumination required, and throughout the period of time required.
 - c. Battlefield illumination should, wherever possible, be provided by an independent source of illumination, so as to allow units the full use of their weapons.
 - d. Illumination should be provided by the highest level practicable in order to conserve the illuminants available to lower echelons.

e. Each ground unit engaged in combat which has a specific need for illumination should have organic means, in accordance with its specific requirements for illumination, sufficient to accomplish the illumination mission or to maintain the required illumination until the illumination mission can be taken over by a higher echelon.

f. Alternative means of illumination should be provided, if available.

g. All battlefield illumination must be coordinated to prevent disclosure to the enemy of the operations of adjacent units. Coordination will normally be accomplished by the commanders having operational control of the illumination means and may necessitate restrictions being placed on the unit organic means.

h. Once artificial daylight is provided to supported troops, it should be provided without interruption until the need for illumination is satisfied. This type of illumination completely eliminates night vision and if interrupted would render supported troops incapable of seeing until night vision is restored.

i. The habitual use of battlefield illumination under any given set of circumstances (i.e., a limited attack or similar maneuver) may tend to reveal prematurely the intention of friendly forces. Care must, therefore, be exercised to prevent establishing a set pattern of operational procedures. Conversely the use of illumination techniques as part of deception plan may be profitable on occasion.

j. Battlefield illumination should be planned and coordinated with the use of infra-red equipment in such a way that—

(1) no damage will be caused to the infra-red equipment by exposure to direct intense white light;

(2) battlefield illumination will be avoided or reduced to an absolute minimum when infra-red operations are going on;

(3) the most suitable means—battlefield illumination or infra-red light—will be used according to the situation;

(4) a rapid change from infra-red light to battlefield illumination—or vice versa—can be performed.

BATTLEFIELD ILLUMINATION TERMS AND DEFINITIONS

5. The definitions that follow are for the purpose of this STANAG only:

a. Battlefield illumination. The lighting of the zone of action of ground combat and combat support troops by artificial means whose effect can be observed by the naked eye.

b. Close-in illumination. Illumination of an area in the immediate vicinity of individuals or units. In general, this area extends outward a distance equal to the effective range of direct fire weapons.

c. Intermediate area illumination. Illumination in the area extending in depth from the far boundary of the close-in area to the maximum effective range of the bulk of divisional artillery weapons.

d. Deep illumination. Illumination in the area extending in depth from the far boundary of the intermediate area to the maximum depth of army influence on the battlefield.

e. Artificial moonlight. Illumination of an intensity between that of approximately a one-quarter moon and a full moon on a clear night.

f. Artificial daylight. Illumination of an intensity greater than the light of a full moon on a clear night. (The optimum illumination is the equivalent of daylight.)

g. Direct illumination. Illumination provided by direct light from pyrotechnics or searchlights.

h. Indirect illumination. Illumination by diffusion or reflection, obtained by using a searchlight from defilade.

i. Illumination by diffusion. Illumination of the area beneath and to the flanks of a slightly elevated searchlight by the light scattered by atmospheric particles.

j. Illumination by reflection. Illumination of an area by reflection of a searchlight beam from low-lying clouds (150 to 900 meters above ground level).

k. Full beam spread. Searchlight beam spread to its maximum width.

l. Pencil beam. Searchlight beam reduced to, or set at, its minimum width.

m. One-half (one-quarter or one-eighth) beam spread. Searchlight beam reduced to one-half, one-quarter or one-eighth of full beam spread.

n. Illumination plan. A plan for prearranged illumination published as an appendix to the fire support plan.

o. Deflection spread. A method of firing illumination shell—each round being fired at the same range and time setting but at a different deflection (azimuth) in order to illuminate an area whose width is greater than its depth. (Dimensions are considered with respect to the Gun-Target line).

p. Range spread. A method of firing illuminations, shell—each round being fired at the same deflection (azimuth) but at a different range setting and time setting in order to illuminate an area whose depth is greater than its width. (Dimensions are considered with respect to the Gun-Target line).

q. Four-round illumination diamond. A method of firing illumination shell—a combination of deflection spread and range spread, providing illumination of a large area.

BATTLEFIELD ILLUMINATION MEANS

6. Following are the principal means of achieving battlefield illumination:

a. Ground Signals, Illuminating Grenade and Trip Flares.

* * * * *

b. Tank-Mounted Searchlights.

* * * * *

c. Artillery and Mortar Illuminating Shell.

* * * * *

d. Naval Illuminating Shell.

* * * * *

e. Searchlights.

(1) Generally, if the illumination is to be of long duration, searchlights will be used since a searchlight is capable of 90 minutes of continuous illumination.

(2) This category includes all searchlights which are not mounted on armored vehicles and which are used for illuminating the battlefield.

(3) Such searchlights are usually from 75cm to 150cm in diameter and may be mounted on trucks or trailers or transported on such vehicles but dismounted for operation. The intensity of the light is from 400 to 800 million candlepower. The searchlights are normally equipped to provide a focused pencil beam or a spread beam. For the United States 60 inch (150 cm) searchlight, the usable range of a focused beam (22 mils wide) on a clear, dark night, is about 18,300 meters.

(4) Indirect illumination is a type of battlefield illumination obtained by using the searchlight from defilade. The searchlight is employed to provide indirect illumination by diffusion or reflection. Reflect-

ed illumination has the same general characteristics as illumination by diffusion.

(5) In diffused illumination, the searchlight beam is elevated slightly above the ground. This causes the area beneath and to the flanks of the beam to be illuminated by the light scattered by atmospheric particles. In general, best results are obtained by using a focused beam with less than 100 mils elevation.

(6) In reflected illumination, the searchlight beam is directed against low-lying clouds (150 to 900 meters above ground level). The area illuminated receives light by reflection from the cloud as well as by diffusion. Best results are generally obtained by use of a focused beam.

(7) Method of requesting. The request for searchlight illumination is similar to the request for artillery and mortar illuminating shell. The request should also include the type of beam which is required.

(8) Control over the use of searchlights is exercised by the supported unit or formation commander.

f. Aircraft Flares.

* * * * *

THE ILLUMINATION PLAN

7. The illumination plan is—

a. prepared by the Fire Support Coordination Centre and/or coordinated by the highest level affected;

b. based upon requests of supported units of formations or as directed by higher echelon;

c. published as an appendix to the unit or formation fire support plan.

8. Coordination is accomplished at all echelons to insure, on the one hand, integration of battlefield illumination with fire support means and, on the other, coordination of the use of all means of illumination. The illumination plan consists of the same elements and has the same format as the artillery fire plan (STANAG 2031) with the following exceptions:

a. The artillery fire plan table becomes the illumination plan table in this instance.

b. As the expenditure of rounds in an illumination mission largely depends upon the atmospheric conditions, the number of rounds to be expended for each mission in the illumination plan table will be replaced by the duration of the mission, given in minutes.

c. For all illumination missions the size of the area to be illuminated, given in the target list in the column size, is expressed as the diameter of a circle. In the case of an illumination mission to be fired by an artillery unit using illumination projectiles the pattern of illumination will be given as well in the column remarks.

3. EXCEPTIONS TO STANAG No. 2088

Since ratification of this STANAG by the United States, the following exceptions are stated and should be used until they are incorporated as a revision to the STANAG by the Military Agency for Standardization:

BATTLEFIELD ILLUMINATION TERMS AND DEFINITIONS

5. The definitions that follow are for the purpose of this STANAG only.

1. Pencil Beam (Focused Beam). Searchlight beam reduced to, or set at, its minimum width.

* * * * *

o. Lateral Spread. A method of firing illumination shell—each round being fired at the same range and time setting but at a different deflection (azimuth) in order to illuminate an area whose width is greater than its depth. (Dimensions are considered with respect to the Gun-Target line).

* * * * *

q. Four-round Illumination Diamond. A method of firing illumination shell—a combination of lateral spread and range spread, providing illumination of a large area.

BATTLEFIELD ILLUMINATION MEANS

6. Following are the principal means of achieving battlefield illumination:

e. Searchlights

(1) Generally, if the illumination is to be of long duration, searchlights will be used since a searchlight is capable of continuous illumination, except for a 1-minute interruption about once each 6 hours for the purpose of changing carbons, and for about 5 minutes during each 4 hours of continuous operation for the purpose of refilling the generator tank with gasoline.

(3) Such searchlights are *** a spread beam. For the United States 30-inch (75cm) searchlight, the usable range of a focused beam (52 mils wide) on a clear, dark night, is about 9,100 meters.

(5) In diffused illumination *** by atmospheric particles. In general, best results are obtained by using a focused beam and an elevation of less than 75 mils. Optimum illumination is obtained at an elevation of 50 to 75 mils. On clear, dark nights the maximum illumination obtainable by diffusion is about equal to that of the light from a quarter moon.

4. SOLOG AGREEMENT 108

DETAILS OF AGREEMENT

The Armies of the United States, United Kingdom, Canada, and Australia agree to adopt STANAG 2088, Battlefield Illumination, including such changes and amendments and revised editions as may be agreed to without reservations by these Armies, in the ABCA Non-Material Program.

5. STANAG'S OF GENERAL INTEREST

The following STANAG's and SOLOG's (Standardization of Operations and Logistics) are not implemented by this manual but are of general interest to users of this manual:

a. STANAG No. 1001 (3rd Ed), Standardized System of Numbering Days and Hours Relative to a Given Operation (R) (SOLOG No. 32). Programmed for implementation in JCS Pub 1.

b. STANAG No. 1059, National Distinguishing Letters for Use by all NATO Armed Forces (SOLOG—Mil). To be implemented in AR 310-50.

c. STANAG No. 2002 (Edition No. 4), Marking of Contaminated or Dangerous Land Areas. Implemented in FM 21-40.

d. STANAG No. 2004 (2d Ed), Toxic Alarm System (U) (SOLOG No. 26). Implemented in FM 21-40.

e. STANAG No. 2007 (2d Ed), Use of Abbreviations by the NATO Armed Forces (SOLOG No. 20). To be implemented in AR 310-50.

f. STANAG No. 2008 (3d Ed), Standard Method of Rendering Enemy Bombing, Shelling, Mortaring, and Toxic Report. Implemented in FM 6-121.

g. STANAG No. 2027 (2d Ed), Marking of Military Vehicles (SOLOG No. 62).

h. STANAG No. 2041 (2d Ed), Operational Road Movement Orders, Tables and Graphs (SOLOG No. 17R). Implemented in FM 55-30, Army Motor Transport Operations.

i. STANAG No. 2047 (2d Ed), Emergency Warnings of Hazard or Attack. Implemented in FM 6-140.

j. STANAG No. 2079 (2d Ed), Rear Area Security and Rear Area Damage Control (SOLOG No. 48R). To be implemented in FM's 21-40, 31-16 and 100-10.

k. STANAG No. 2101 (2d Ed), Principles and Procedures for Establishing Liaison (SOLOG No. 104). Implemented in FM 100-5 and FM 61-100.

l. STANAG No. 2104, Friendly Nuclear Strike Warning to Armed Forces Operating on Land. Implemented in FM 6-20-1.

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